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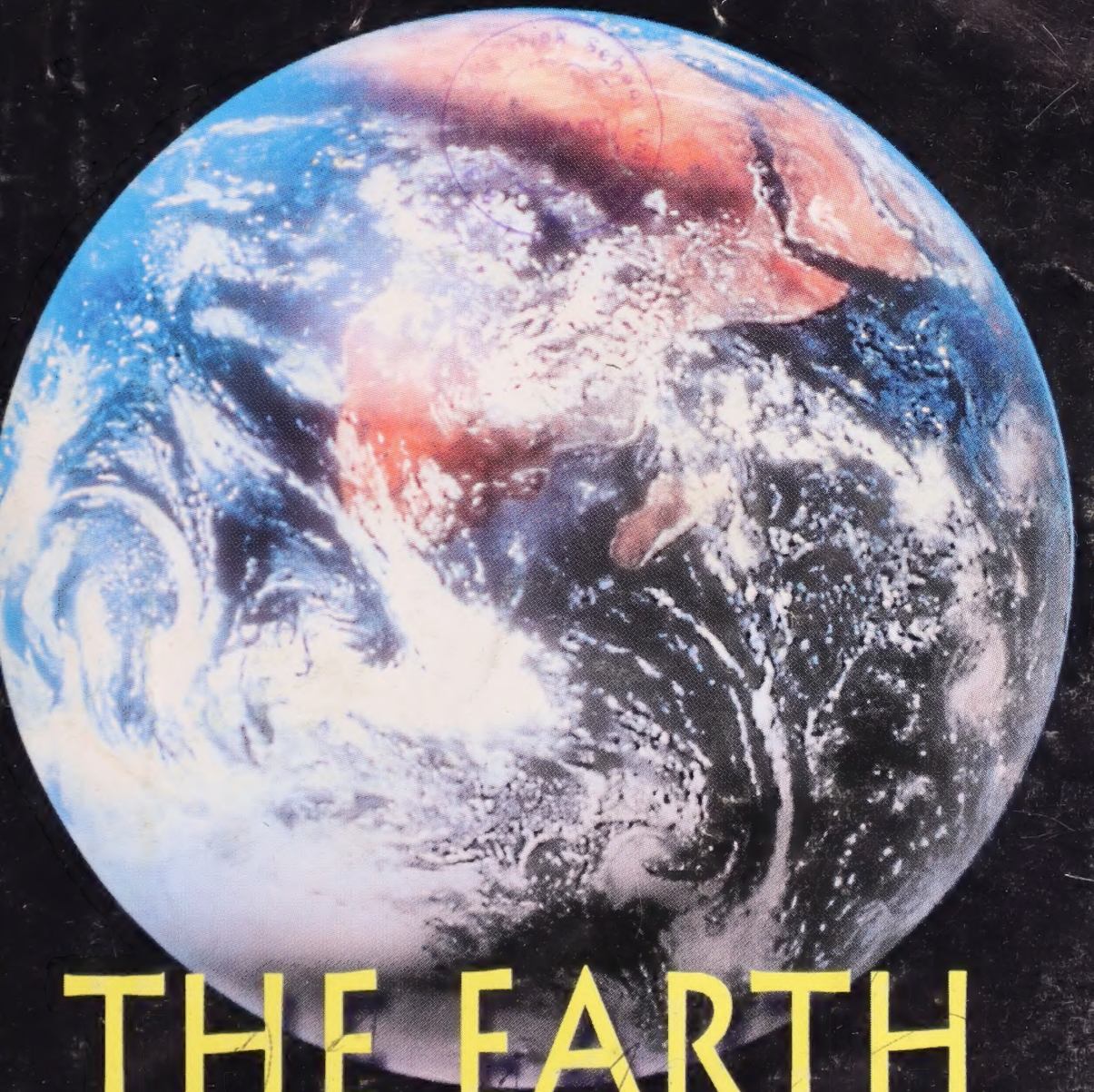

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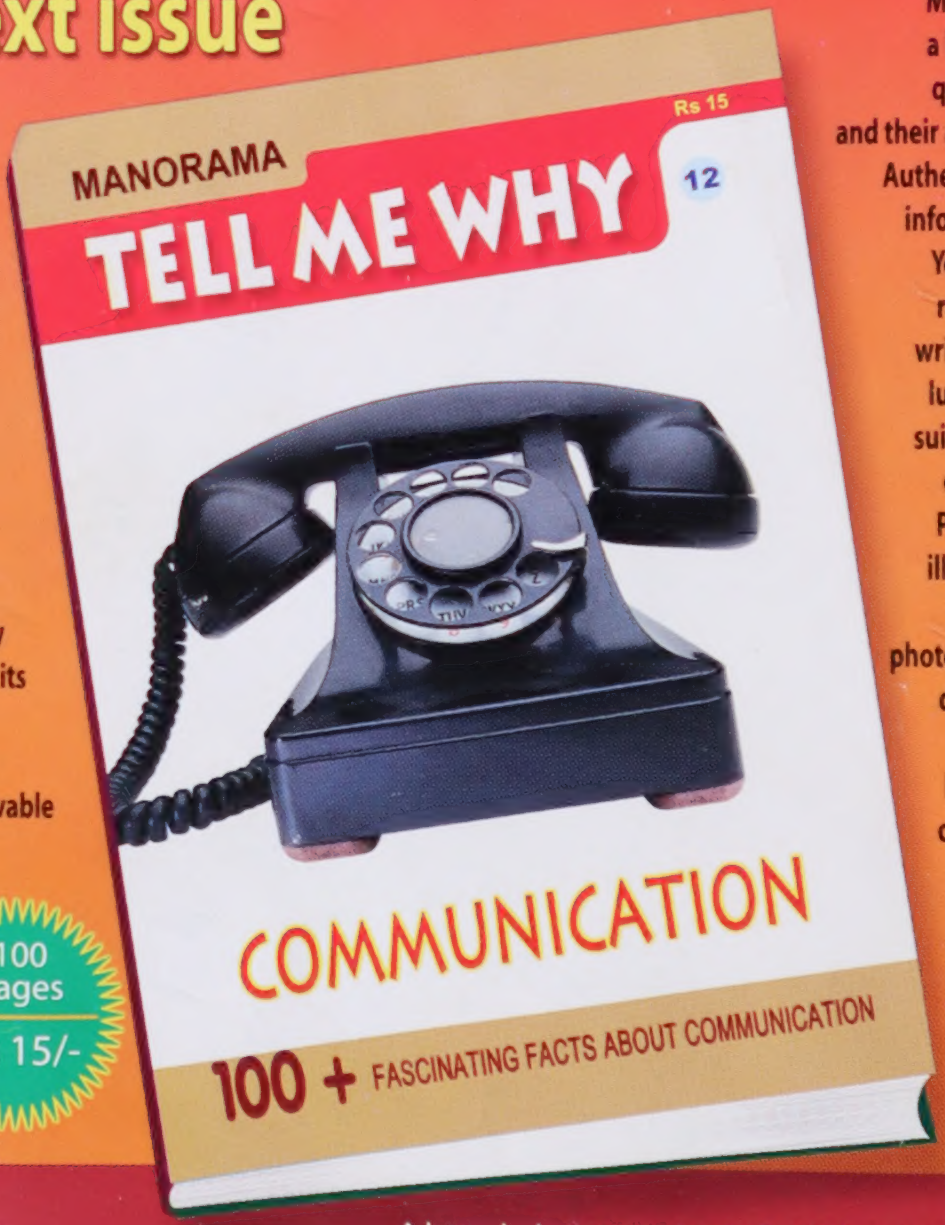

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ACC. No: 8288
CLASS No:
13/12/08

MANORAMA
TELL ME WHY

AUGUST 2007 • VOLUME : 1 • NO : 11

M M Publications Ltd., P.B. No. 226,
Kottayam, Kerala, India. Pin - 686 001
Tel : 0481-2563721-22-23.
Fax: ++91-481-2564393.
E mail: subscription@mmp.in
childrensdivision@mmp.in

NEW DELHI: M.M.Publications Ltd., 68/6, 1st Floor, Tolstoy Lane, Janpath, New Delhi -110 001. Tel: 23752781/ 23326372

MUMBAI: Malayala Manorama,1st Floor, Unit No. 111 & 112, Prime Plaza, J. V. Patel Compound, B. M. Marg, Elphinstone West, Mumbai. Tel: 24385980-83

KOLKATA: Malayala Manorama, No. 43/2-B, Suhasini Ganguli Sarani, 1st Floor, Kolkata - 700 025. Tel: 033 - 24556995, 24555962. Fax : ++ 9-033 - 24556995

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CHENNAI: Malayala Manorama, 2nd Floor, # 748, Anna Salai, Chennai. Pin. 600 002. Tel: : 28542607 (Circulation-Direct), 28542601 to 06 (Board Line).Fax: ++ 91- 044- 28542611.

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Our Living Planet

Our earth is the third planet from the Sun in the solar system. It combines many of the features of other planets, along with some unique ones that are all its own. As far as we know, it is the only planet where life exists.

No one knows just how the earth came into being. Scientists have put forward many theories about this. The time of earth's formation is also disputed. Many scientists now believe that our earth is about 4.6 billion years old.

The earth is a great globe of rock surrounded by an envelope of air. The earth is the only planet in the solar system with an oxygen-rich atmosphere, with both liquid water and frozen ice. About 71 percent of earth's surface is water, and 21 percent is land. Water lies in basins in the rock, making oceans, seas, and lakes.

Man has always been curious about the amazing planet on which he lives. Hundreds of years of hazardous endeavours by brave scientists have brought to light many startling facts about the inside and outside of the earth. In this issue, Manorama Tell Me Why is going to tell you all you want to know about our amazing, living planet.

FROM THE HOUSE OF MAGIC POT, MANORAMA YEAR BOOK, VANITHA, THE WEEK AND THE MALAYALA MANORAMA DAILY

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The Evolution Of The Earth

How was the Earth formed?

When you look around and see mountains, valleys, rivers and plains, don't you find it difficult to believe that millions of years ago, the earth did not even exist? In fact, our sun was just another star in the solar system, and it was only about 4,600 million years ago that the earth and other planets were formed around it. Do you know how this happened?

Gases and other small particles of matter first came together and clung to each other to form a cloud. Gradually, this cloud became a ball. The ball began to heat up from the inside, melting the matter, and forming a crust on the outside. Gases and steam from the hot liquid centre erupted to form water and the atmosphere. Then the crust cooled and hardened, and our earth came into existence. The parts of the crust lying high became the continents, and water collected in the low lying parts to form the oceans.

You know that our earth is only a very tiny part of the Universe. Did you know that scientists believe that the universe itself began about 13 and 18 billion years ago? According to some scientists, the Universe began with an awesome explosion that they call The Big Bang.

What is the Continental drift?

You know that the continents are large masses of land. You would think that they would remain fixed in one place. But the fact is that the continents are moving very, very slowly, all the time. This movement of the continents is called the Continental Drift.

It was a German scientist called Alfred Wegner who first claimed that the continents are drifting. They sometimes collide with each other to form mountains, and sometimes break apart in the middle. According to him the surface of the earth called the crust, is made up of rocky material. Underneath the crust lies a thick shell called the mantle, which surrounds the fiery molten heart of the earth.

Wegner

Towards the centre of the earth, the rocks are like toffee, and are easily deformed. This layer is called the aethenosphere. But the outer part of the earth is very hard and rigid, and it is called the lithosphere. It is made up of several plates called the tectonic plates on which the continents rest. These plates are floating over the aethenosphere below, and it is this movement that causes the continental drift.

How fast are the continents moving?

We know that the surface of the earth is broken into large pieces or plates that are slowly shifting. The continents rest on these plates, and the speed at which they move varies from place to place. It has been calculated that continents move at about the same speed at which your fingernails grow... about an inch an year. This may seem to be very slow, but over millions of years, the continents can travel thousands of miles. In fact as a result of this movement, in 50 million years Africa will collide with Europe, the Atlantic will be wider, and Australia will move to the north!

Why can you fit South America and Africa together like a jigsaw puzzle?

If you look closely at the map of the world you will notice that east coast of South America fits exactly against the west coast of Africa, as if they were pieces of a jigsaw puzzle. This is because millions of years ago, they were joined. In fact, 220million years ago all the continents were joined together to form one super continent called Pangea. There was also only one giant ocean, Panthalassa.

World map showing the continents

In time, Pangaea split into smaller land masses, and the continents began to drift to-

wards their present positions. In the future, the movements of the tectonic plates will cause the continents to drift even more. This will result in the Pacific Ocean shrinking, the Atlantic Ocean getting wider, and Africa splitting into two!

What happens when continents crunch together?

When continents crunch together, the edge of one continent crumples up to form high mountain ranges. The Himalayas were formed in this way, and they are getting higher and higher because India is still crunching up against Asia!

In a similar manner, Africa has been pushing up into Europe over millions of years. This collision has pushed up the Alps and the Pyrenees mountains!

The area of maximum movement is around the Pacific Ocean. As the plates supporting the continents buckle and squeeze against each other, earthquakes occur. Holes also appear in the earth's crust, through which molten rock is thrown out. These are the volcanoes for which this region is famous.

STAR FACT — The Earth's Vital Statics

Diameter	12,756 km
Average distance from the sun	149.6 million km
Orbital speed around sun	29.8km/s
Equatorial circumference	40,076 km
Surface area	509,600,000 sq km

According to the Big Bang theory, how was the Universe formed?

The Big Bang theory is an effort to explain what happened at the very beginning of our universe. Scientists have no doubt that our universe did begin at a specific point in time. Before that moment, there was nothing. During and after that moment, the universe came into existence. The Big Bang theory is an effort to explain what happened during, and after, that moment.

Our universe is thought to have begun as an infinitesimally small, infinitely hot, and infinitely dense speck of matter. Where did it come from? We don't know. Why did it appear? We don't know. This unimaginably small, incredibly hot little ball expanded and burst in a gigantic explosion between 10 and 20 million years ago. This cosmic explosion hurled matter in every direction, and is called The Big Bang. Within a split second, all the forces that shape the universe and all forms of matter were created.

The explosion was so immense, that material is still hurtling away in all directions at astonishing speeds. The universe created by the Big Bang continues to expand and cool to this day. We ourselves are incredible creatures living on a unique planet. This beautiful planet circles a brilliant star,

which is just one of several hundred billion other stars in a galaxy soaring through the

Big Bang: An artist's imagination

cosmos...and it all began with a Big Bang!

Will the Big Bang happen again? Something that happens once can happen again, it is true. However, scientists believe it will not happen again in our Universe.

What was the early universe like?

Scientists have a good idea of what the early universe was like, based on the laws of physics, mathematical calculations and experiments with sophisticated machines.

After the Big Bang, theorists say, the universe was hotter than the sun. There were no stars, but rather, a searing soup of hydrogen nuclei, and electrons that raced around on their own.

As space expanded, the universe cooled, allowing the hydrogen nuclei to capture electrons, making what is called neutral hydrogen. The early universe was opaque, blocking the release of light like morning fog.

The first stars were incredibly massive, containing perhaps 200 times more material than the Sun, but they will perhaps never be seen because they were born amid this cosmic fog. In time, the fog lifted, allowing light to travel through the cosmos. The galaxies that developed during that time are so far away that they are difficult to detect.

How is soil formed?

Soil covers much of the land on earth. Do you know how it is formed?

We know that the surface layer of the earth is covered with rock. Wind, water, and temperature changes will make even the hardest of rocks crumble into tiny pieces over millions of years. The pounding seas, moving glaciers and roots of plants growing in cracks of rocks, all help in breaking them up.

Bacteria transform the bodies of almost all decaying plants and animals into soil. This matter is known as humus, and it makes the soil fertile. Earthworms and many types of insects too help to make the soil rich.

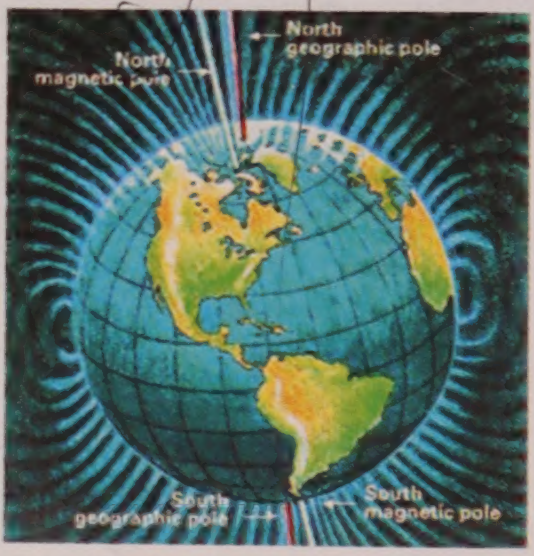
The topmost layer of soil is known as topsoil. Topsoil is rich in humus, and supports plant life. The next layer is called the subsoil, and has bits of rock mixed with soil. Underneath it all, is a layer called bedrock, which is rock that has not been broken up by the elements.

Just imagine what would happen if there were no soil? Plants would not be able to grow, and without plants, there would be no animals or human beings as there would be no food!

How is the earth like a magnet?

Hold a compass in your hand and it will point to the earth's north pole. Why does this happen? Because the Earth is like one giant magnet and the compass points to the magnetic north pole.

Why does the earth act like a magnet? We know that at the centre of the earth lies a molten, metallic iron rich core. We also



Graphic showing earth's geographic and magnetic poles

believe that this core is spinning. The metals in the core have many loosely bound electrons. These particles can conduct electricity. It is this mass of moving electrons which produces the magnetic field.

To best understand Earth's magnetic field, picture a bar magnet and a bunch of iron filings dumped around it. The filings form lines running from the north pole of the magnet to its south pole. The compass is acting somewhat like the iron filings, and is pointing towards the north pole.

What hold things in place in space?

Have you ever wondered what holds things up in space? Why the moon or the stars do not fall down? Well, all matter in the universe, whether it is a star or a particle of dust, is held in place by four forces.

Two of them are very familiar - electromagnetic force, and gravitational force. You may not have heard of the other two. They exist deep inside the nucleus of atom. One is strong, the other weak, and they hold the particles of every atom together.

Why don't people fall off the earth?

If you throw a ball up into the air, it will not keep going higher and higher until it disappears into the sky. It will come back to you. This is because of a force known as gravity.

The force of gravity is the force with which the earth, moon, or other massive body attracts an object towards itself. All objects upon earth experience a force of gravity which is directed downwards, to the centre of the earth. It is gravity which pulls things back to the surface or keeps them there...and it is gravity that keeps us from falling off the surface of the earth!

The Structure Of The Earth

Is the earth a perfect sphere?

If you look around you, the earth looks flat. Even before the Middle Ages, people did think it was flat. The shape of the earth has intrigued scientists throughout history. Pythagoras was the first person to talk about the earth being spherical, but people did not accept his view. The flat earth concept persisted till about 300 years ago. In fact, people used to think that if they sailed too far in one direction, they would fall off the edge of the earth!

It was Sir Isaac Newton, an English

What is inside the earth?

If you could make a journey into the heart of the earth, what would you find? Well, you would start from the surface of the earth, which is a hard crust of rock. The rock is not continuous, but has many cracks. This is split up into large slowly moving plates called tectonic plates.

As you go deeper and deeper, you would notice many changes. To begin with, it would get hotter and hotter, as you enter the next layer. This is called the mantle. The mantle is so hot, that the rock here is not solid but molten. The molten rock, known as magma is constantly moving.

About 6400 kms below the surface, you will reach the core of the Earth. The earth has an outer core, and an inner core. This is made mainly of molten iron, and the temperature in the heart of the earth is a fiery 5500 degrees centigrade!

Of course, no one has ever gone so deep into the earth. But scientists know what it is like from their studies of earthquakes.

Isaac Newton

scientist, who first claimed that the earth is not spherical, but 'oval'. Today, we know that the earth is not a perfect sphere. It is slightly flattened at the poles, and it bulges at the equator. This is caused by the rapid spinning of the earth. In recent years, scientists have learned that there is another small bulge at the North Pole. So the earth is now considered to be somewhat pear-shaped!

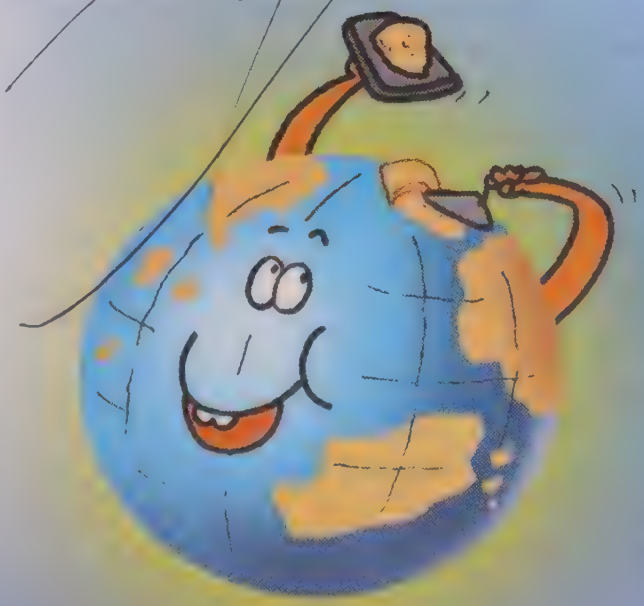
What is the earth's crust, and how big is it?

The Earth's outermost surface is called the crust. The thickness of crust varies from about 40 kilometres to about 10 kilometres.

The earth's crust is like the skin of an apple. It is very thin in comparison to the other three layers.

The temperatures of the crust vary from air temperature on top, to about 870 degrees Celsius in the deepest parts of the crust. Since you can bake a loaf of bread in oven at 175 degrees Celsius, you will understand why at 870 degrees Celsius, rocks begin to melt!

The crust of the earth is broken into many pieces called plates. The plates 'float' on the layer below. These plates usually move along smoothly, but sometimes they stick and build up pressure. The pressure builds and builds, and the rock bends until it snaps. When this occurs an earthquake is the result!



Where does the earth's crust end?

The earth's crust is about 40 kilometres thick beneath continents, and about 10 kilometres thick beneath oceans. It occupies only about 1 % of the earth's volume, and ends at the next layer called the mantle.

The earth's crust meets the mantle along a boundary called the Mohorovic discontinuity. Since the top of the mantle is as rigid as the crust, scientists often group the upper portion of the mantle with the crust, and call it the lithosphere.

What is the earth's mantle?

The mantle of the earth is a 2,900 km thick rocky shell comprising approximately 70% of earth's volume. It lies under the crust and is made up of two layers.

The earth's mantle is thought to be composed mainly of olivine-rich rock. It has different temperatures at different depths. The temperature is lowest immediately beneath the crust, and increases with depth. The highest temperature occurs where the mantle material is in contact with the heat-producing core.

The outer part of the mantle is about 600 kms thick. Its temperature is about 2000 degrees celsius, and is composed of molten rock called magma, which has the consistency of hot tar. It is under great pressure, and sometimes bursts out of cracks on the earth's surface as a red hot volcanic eruption.

The inner layer of the mantle is under even greater pressure. In fact, the pressure is so great that the rock is more solid than the outer layer, but not rigid. It is like plastic, and moves very slowly.

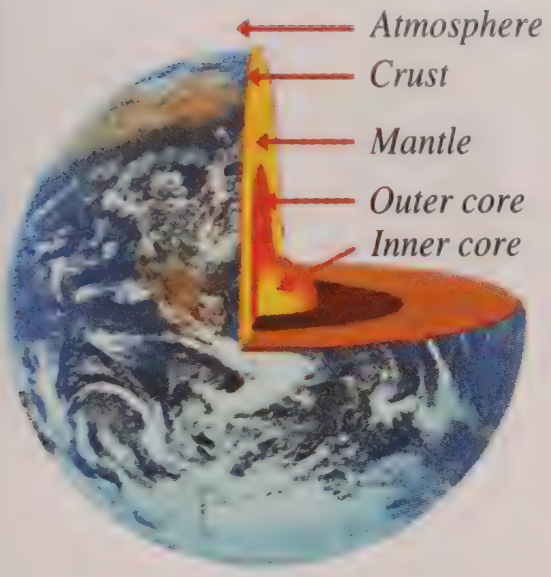


Image showing the earth's interior parts

Are there any gaps in the crust?

We know that the earth's crust is not one huge shell of solid rock. There are many cracks in the crust, and these cracks form gaps.

The crust, or rather the lithosphere, is actually broken into 20 or so giant plates called tectonic plates. Since these plates are always shifting, the gaps keep widening and narrowing. Sometimes, molten rock from the layer underneath the crust pushes up through these gaps, and volcanoes are formed.

STAR FACT

The earth is the only planet with its crust split into moving plates.

What is the core of the earth?

The core is the heart of the earth. It consists of a fluid outer core, and a solid inner core.

The outer core has temperatures up to 3000 degrees celsius. It is made up of mainly liquid iron that flows in giant corkscrew like currents. These currents produce the earth's magnetic field.

The inner core of the earth is even hotter. The temperature can go up to 5500 degrees celsius. Because of the tremendous pressure, the iron crystals in the inner core form a solid ball.

Why is it hot inside the earth?

The inside of the earth is unimaginably hot. The deeper you go, the hotter it gets. Every 40 metres, the temperature rises by another degree. About 4 kilometres below the surface of the earth, it is hot enough for water to start boiling. At the very centre, it is a mind blowing 5500 degrees celsius!

Why is it so hot at the centre of the earth? We know that the earth was once a hot, whirling mass of gas, liquid, and tiny particles that began to orbit the sun regularly. As millions of years passed, it took a ball like shape, and cooled very slowly. A hard crust formed on the surface, but the heart remained as hot as before...and remains as hot to this very day.

Erupting volcano

How do we know about the interior of the earth?

Scientists have been able to understand what the interior of the earth is like by studying volcanic eruptions that bring up hot gases, and earthquakes.

When an earthquake occurs the vibrations it causes spread out in all directions and are called seismic waves. Seismic waves can be detected with very delicate instruments. It has been noticed that they travel at different speeds through different materials. Their direction also changes as they go from one kind of rock to another.

STAR FACT

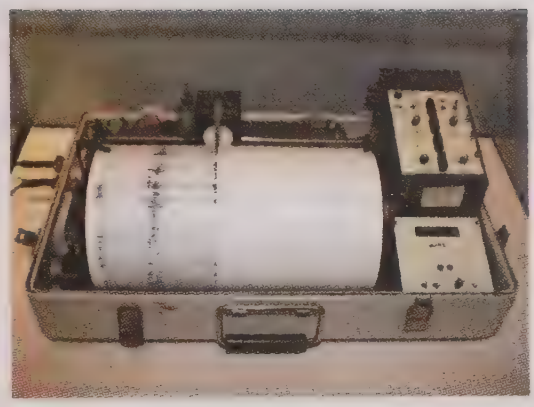
10 LONGEST RIVERS IN THE WORLD

Name	Length(Km)
1. Nile	6632
2. Amazon	6400
3. Mississippi-Missouri	5936
4. Ob-Irtysh	5536
5. Yangtze	5440
6. Huang Ho	4800
7. Congo	4350
8. Amur	4320
9. Lena	4288
10. Mackenzie-peace	4216

The two main types of seismic waves are body waves and surface waves. Body waves travel through the earth's interior in all directions. Surfacewaves travel only along the surface of the earth, like ripples on water. It is the behaviour of body waves that gives us clues about the nature of earth's interior.

One type of body wave, the 'P' wave, slows down and changes direction at a depth of about 550 metres. Another type, the 'S' wave stops entirely at this depth. This shows that there are significant changes in matter. a Scientists have concluded that this is the boundary between the mantle of the earth and its outer core.

Since 'S' waves cannot travel through liquid, scientists concluded that the outer core is liquid. The 'P' waves



Seismograph

continue till a depth of more than 5000 kilometres. When they change direction again, showing that they have reached a solid innercore.

As far as surface waves are concerned, the speed at which they travel gives us information about the types of rocks found near the surface of the earth.

So it is the information about seismic waves gathered by scientists, and their study of volcanic eruptions, that give us insights into what the interior of the earth is like.

Can we ever visit the centre of the earth?

There is a famous book 'Journey To The Centre Of The Earth' written by the French author Jules Verne. The story is about a professor who leads his nephew and hired guide down a volcano in Iceland to the 'centre of the earth'. They encounter many adventures, including prehistoric animals and natural hazards, eventually coming to the surface again in southern Italy.

Experts inspecting rocks

Jules Verne's classic makes for exciting reading, but it is pure fiction. The centre of the earth is not a nice place to visit, unless you like hanging out in a blast furnace. The outer core of the earth, about two-thirds of the way to the centre, is molten iron. Deeper yet, at the inner core, the pressure is so great - 3.5 million times surface pressure - that iron solidifies, even though the temperature is hotter than the surface of the sun!

For these very reasons, it can be safely said that it is unlikely that you can visit the centre of the earth anytime in the near future.

Since the ground is flat, why do we say the earth is round?

We know that the earth is round, yet the ground around us looks flat. This is because, in comparison to the earth, we are very, very tiny. We can see only a small portion of the earth at a time, which is why that portion looks flat.

What are rocks and minerals?

The earth's crust is made up of rocks. A rock is usually defined as a mixture of common minerals. Rocks can be hard or soft, as small as a grain, or as large as a building.

Geologists classify rocks based on how the rocks were formed. The three classes are igneous rocks, metamorphic rocks, and sedimentary rocks.

Igneous rocks are formed when molten lava cools and hardens. Sedimentary rocks are formed when tiny particles are worn away from other rocks and settle into layers on the sea bed. They slowly get cemented by chemical action into hard rock again. Metamorphic rocks are formed when existing rocks change to form new rocks because of great changes in pressure or temperature.

Sedimentary rocks

Minerals are natural compounds formed through geological processes. Minerals range in composition from pure elements and simple salts, to very complex silicates.

Different samples of the same mineral react in the same way. There are over 3000 different minerals. All minerals except mercury are solid, though they do melt under tremendous heat and pressure. Some minerals make up the common rocks on the earth's surface. Some, like gold and diamonds, are extremely rare and valuable.

What is the difference between metamorphic rocks and sedimentary rocks?

Sedimentary rocks are made from pieces of other rocks that have been worn away by the elements. These pieces have been pushed down underneath the surface of the earth or seabed, and have then been cemented together by extreme pressure. Some sedimentary rocks are formed from particles of once living things, such as ancient forests. Others are formed from minerals that crystallize from sea water. Limestone, sandstone and shale are some sedimentary rocks.

Metemorphic rocks, and sedimentary basin on extreme right

Metamorphic rocks are formed much deeper beneath the earth's crust. Here, igneous and sedimentary rocks are altered by extreme heat and pressure to form new rocks. Marble and slate are metamorphic rocks.

Why do rocks change?

There is a phrase in English that says 'as unchanging as a rock'-but the fact is that rocks are changing all the time! They are constantly being worn away by the elements.

Wind, rain, sleet and snow wear away igneous and sedimentary rocks on the earth's surface. These fragments are washed by rain or carried by rivers into the sea. Here, they accumulate in layers and gradually turn into new sedimentary rocks.

Some of the sedimentary rock is pushed so deep beneath the

surface that it is transformed by heat and pressure into metamorphic rock. The movement of the earth's tectonic plates pushes up the metamorphic rock to form new mountains. Thus a cycle is completed and this process is known as the rock cycle.

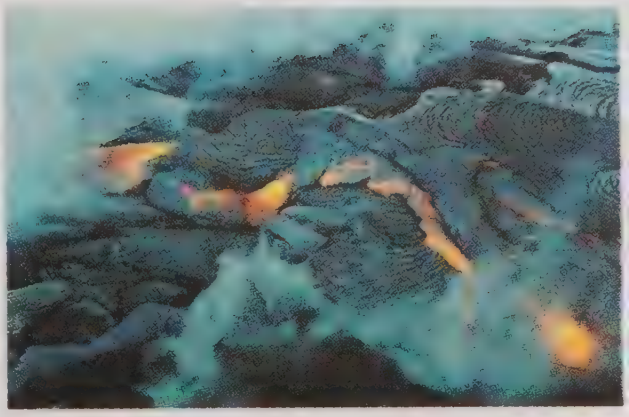
The cycle continues. Mountains made of metamorphic rocks can

Sedimentary rocks on a shore

be broken up and washed away by streams. New sediments from these mountains can make new sedimentary rock. So that is why we can say that rocks are ever-changing!

Which rocks come from fire?

Deep inside the earth, igneous rocks are formed when the fiery melted rock called magma



Lava flowing from a volcano

is trapped in small pockets. As these pockets of magma cool slowly underground, the magma solidifies to form igneous rocks. Such rocks formed underground are called intrusive igneous rocks.

Igneous rocks are also formed when volcanoes erupt. When this happens, magma appears above the earth and it is called lava. Igneous rocks are formed as the lava cools and solidifies above the ground. These igneous rocks formed above the surface are called extrusive igneous rocks.

Igneous rocks are also called 'fire rocks' because they are born from fire.

What are precious stones?

A precious or semi precious stone, also called a gem or gemstone, is a highly attractive and valuable piece of mineral. They are greatly prized, because they are rare, beautiful, and hard-wearing.

There are over 3000 types of minerals, but only about 50 are valued as precious stones. Most of them are crystals formed when magma cooled slowly deep underground. So it is very difficult to reach them. They can be found by mining, quarrying or sifting the mud and sand from river and stream beds.

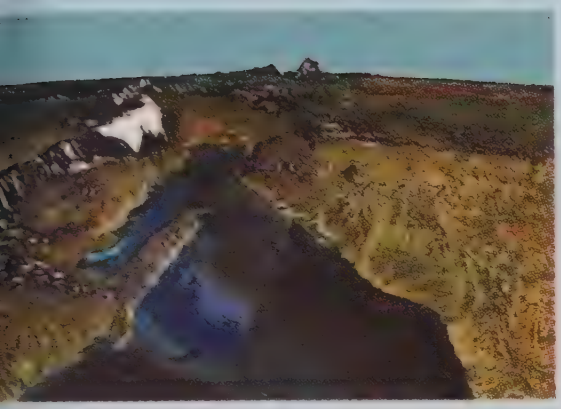
The most precious of stones are diamonds, rubies, emeralds and sapphires. Of these, the diamond is the most prized gem.

Why is the desert dry?

Have you ever wondered why the desert is so dry and hot? The main reason for this is that deserts get very little rainfall, and the amount of rain determines the amount of plants that grow there.

Deserts near the equator are dry, even though the ocean is not far way. This is because in these places, instead of hot air rising, and being replaced by cool moist air, air settles downwards and becomes warmer and drier as it does so. This phenomenon is re-

Sahara



The Great Rift Valley

sponsible for the lack of moisture in deserts. The Sahara Desert and deserts of Western Australia are caused in this way.

Deserts that are far away from the equator are generally dry because of their distance from the sea. This prevents moisture laden winds from reaching them. Sometimes, there are mountains which act as barriers to the winds. These mountains will get rainfall on the side facing the sea, but the side facing land doesn't get any rain. The deserts of Central Asia and the Western United States are good examples of this.

There are sandy deserts, where the wind builds sand hills or dunes. Rocky deserts consist of bare rocks. Other deserts contain barren mountains and dry plains of soil and gravel. Cold deserts are located near the Arctic part of the world.

Can land bend and crack?

Indeed it can. Actually, only very few parts of the land we see around us are actually flat. Even if the surface looks flat, the layers of rock beneath may be bent. Hills and valleys, cliffs and canyons can be caused by rocks being worn away by the weather. They can also be caused by rocks being bent into folds by the movements of the tectonic plates beneath the surface of the earth.

These plate movements can also cause layers of rock to crack and form faults or rifts. The Great Rift Valley in East Africa is actually a series of cracks that are up to 4000 kms deep!

Marks formed by the tension between tectonic plates in North America

The Earth And The Universe

What does the Earth look like from outer space?

Apollo astronaut Gene Cernan joked to Mission Control in 1972 from 48,000 kilometres out in space 'I know we're not the first to discover this, but we'd like to confirm, from the crew of Apollo 17, that the world is round!'

Our home planet is, no doubt, a very interesting place. From space, it looks like a big blue marble, with the constantly changing cloud patterns giving it an ever-changing appearance. Because over seventy percent of Earth's surface is covered with water, the predominant colour you would see from space is blue.

However, the continents would provide an interesting colour show of their own, ranging from the stark white of Antarctica, through the browns of north Africa and on to the mostly greens of Asia and the Americas. At the same time, the oceans and our atmosphere interact with each other to create constantly changing cloud patterns that would resemble a kind of kaleidoscope.

Apollo 17

How long does it take the earth to complete one turn?

The earth takes exactly 23 hours, 56 minutes and 4.09seconds to complete one turn on its axis. However, since it is moving around the sun as it turns, it takes exactly 24 hours for us to see the sun in the same place in the sky. That is why we say one day is 24 hours long.

The Earth also takes 365.242 days to travel around the sun,

and for the sake of convenience we calculate a year to be made up of 365 days.

What are the unique features of Earth as a planet?

There are a number of things that make our planet unique in the solar system. To begin with, we are the only planet so far that we know for certain, has ever had life of any kind. This may change in the future, but so far, we are the only planet that supports life.

Life is possible on earth because most of the surface of our planet is covered with water and we are protected from most of the sun's dangerous radiation by our atmosphere. Our atmosphere, which is the layer of gas surrounding earth, is made up of about 77% nitrogen, and about 21% oxygen, which is what we humans and animals breathe. Other gases occur in variable concentrations.

In short, our planet is unique in that it is warm- but not boiling, cold-but not freezing all the time. Water covers three-fourth of its surface, and its atmosphere contains oxygen...which is why it is the only planet in the solar system that has life.

What is the position of the earth in the galaxy?

Our sun is just one of 100 billion stars arranged in a shape like a fried egg. This huge star city is called a galaxy, and it is more than 100,000 light years in width. Our galaxy is in turn, only one of billions of galaxies scattered throughout space... which gives you an idea of how tiny our world is!

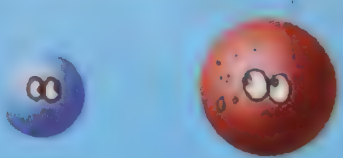
The location of the earth in our solar system, galaxy and universe can mean the difference between the lush, vibrant planet on which we live, and a barren wasteland, devoid of life. If a planet is too close to its star, it is doused with solar radiation. It becomes superheated like Venus, which has a surface temperature of approximately 700 degrees Fahrenheit. Some planets are so far away from their star that they are icy wastelands.

The Earth is just one planet whose distance from the sun is just right to support life.

How far is the earth from the sun?

The Earth is the third planet out from the Sun, between Venus and Mars. On an average, the earth is 148.8 million kilometres away from the sun, but the distance varies depending on the time of the year.

The earth is closest to the sun on January 3rd, and this is called the perihelion. It is farthest away from the sun on July 4th, and this is called the aphelion.



Who are the neighbours of planet earth?

Of the other planets revolving around the sun, Venus is the closest, followed by Mars. Our other neighbours are Mercury, Jupiter, Saturn, Uranus, Neptune and Pluto, which is a dwarf planet.

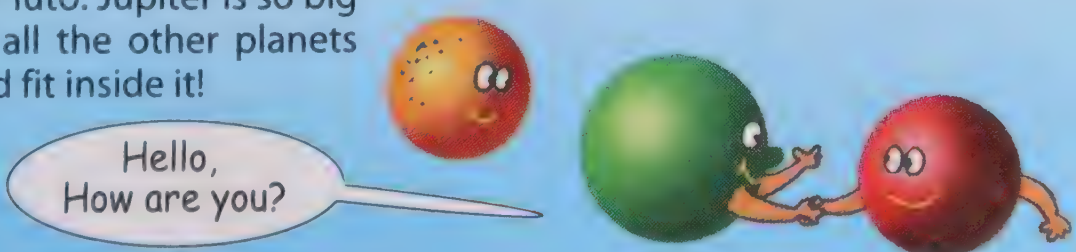
Asteroids, comets, and other rocks and gas also orbit the sun. They are, in a way, our neighbours too!

The biggest of all our neighbours is Jupiter. It is followed by Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury, and finally, tiny Pluto. Jupiter is so big that all the other planets could fit inside it!

Why is the same face of the moon turned towards the earth always?

We all know that the earth rotates on its axis, even as it revolves around the sun. Similarly, the moon also spins on its axis as it orbits the earth.

We also know that the moon's tidal forces cause the high and low tides on the earth. In the same way, the earth exerts tidal forces on the moon. The tidal forces exerted by the earth are very powerful and these forces slow the rotation of the moon. As a result, moon rotates on its axis only once every 27.3 days, which is exactly the same time it takes to orbit the earth once. This means that the moon only shows one face to the Earth.



Meteorite

Ceres

What is a meteorite?

A meteorite is a natural object originating in outer space that survives an impact with the earth's surface without being destroyed. While it is still in space, a meteorite is called a meteoroid.

When a meteoroid enters the atmosphere, it heats up and emits light, forming a fireball. It is then known as a meteor, or shooting star.

Only very large meteroids reach the earth as meteorites. The largest known meteorite still lies where it fell in Hoba West, in Namibia in South West Africa. It is over two metres across, and weighs as much as 60 medium sized cars!

What is an asteroid?

Asteroids are also called minor planets or planetoids. They are a diverse group of small celestial bodies that drift in the solar system and are in orbit around the sun.

The first asteroid to be discovered, Ceres, is the largest known asteroid to date. It measures about 1000 kilometres across its width. The vast majority of asteroids are found within the main asteroid belt, with elliptical orbits between those of Mars and Jupiter. Some though, pass through the earth's orbit, while others go beyond Saturn.

Hundreds of thousands of asteroids have been discovered within the solar system, and the present rate of discovery is about 5000 per month!

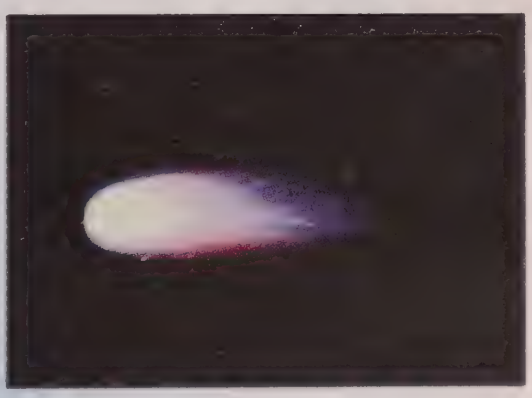
What is a comet?

A comet is a small body in the solar system that orbits the sun and at least occasionally, exhibits a tail. Did you know that comets are sometimes called 'dirty snowballs'? This is because they are icy bodies in which particles of sand and dust are mixed with.

When a comet passes near the sun, the heat of the sun turns the ice into gas, and the dust pours out into space. This gives the comet a long tail, and a hazy look as well. As the comet approaches the sun, its tail can become several million kilometres long!

Comets are invisible except when they are near the sun. They are at their brightest when they are closest to the sun, and as they move away from the sun, they become fainter and fainter until they cannot be seen at all.

Comets move in orbits that are elongated. Some of them have eccentric orbits and are seen only once. Others, like Halley's Comet, have regular orbits. This means we can know exactly when they will will be seen again. For example, Halley's Comet will next be seen in 2061.



Halley's Comet

What would happen if a comet hit the earth?

The chances of a comet hitting the earth are very, very small indeed. A serious collision may occur only once in a hundred million years.

A collision with a comet would not do as much harm as a collision with an asteroid of the same size. The reason is that comets contain mainly frozen liquid and dusty rock particles, while asteroids contains solid rock and metals that can cause great damage on impact.

In 1910, the tail of Halley's Comet swept across the earth. However, since the tail was very thin and made up mostly of dust particles, no damage was caused.

What causes the seasons?

During the year, the seasons change depending on the amount of sunlight reaching the earth as it revolves around the sun. The seasons are caused by the tilt of the earth on its axis as it travels in a loop around the sun each year.

In some places, the sun's warmth makes winds blow from the land to the sea. The air will be dry then, and it will be the dry season in these places.

As the earth continues on its orbit, the winds change direction. They will now blow from the sea to the land, and the rainy season will begin.

You may have also noticed that during summer, the days are longer. This is why it can get so warm during the summer. The long hours of sunlight really heat things up.

In the winter months, the days are shorter.

Milky Way Galaxy

Why do we say the earth is moving all the time?

Even though the earth may seem still to us, it is actually moving in three ways all the time!

Firstly, the earth rotates on its own axis (the axis is an imaginary line drawn from pole to pole). It takes the earth 24 hours to finish one rotation.

Secondly, the earth revolves around the sun. One revolution around the sun takes 365 days, which is one year.

Thirdly the earth is part of the Solar System, and races through space as a part of the Milky Way Galaxy.

When the days become shorter, the sun does not have as many hours to warm the earth, so it will be much cooler.

Winter in Switzerland

In the tropics, there are generally just two seasons – the dry season and the rainy season. In temperate regions though, there are four seasons- spring, summer, autumn and winter.

Did you know that, because of the tilt of the earth, the seasons are reversed in the Northern and Southern Hemisphere? So when it is summer in the Northern hemisphere, it will be winter in the Southern hemisphere!

What causes tides?

The moon, like the earth, has a force of attraction too. This is called its gravitational pull. This causes bulges in the earth's oceans.

The moon pulls water toward it, and this causes the ocean to bulge toward the moon. The bulge on the side of the earth opposite the moon is caused by the moon 'pulling the earth away' from the water on that side.

If you are on the coast and the moon is directly overhead, you should experience a high tide. If the moon is directly overhead on the opposite side of earth, you should also experience a high tide.

As the earth spins on its axis, every place will pass through two tidal bulges each day. So every place on the coast will experience two high tides and low tides as the sea level rises and falls twice a day.

Why do we have leap years?

Generally we calculate one year as 365 days. But it is not exactly correct. The earth takes 365.242 days to go around the sun. But for the sake of convenience, a year in our calendar is calculated to be 365 days. This means that every four years, we get an extra day. So every fourth year is called a leap year, and the extra day is added to the month of February. That is why February has 29 days in a leap year. Even so, to keep our calendar accurate, we must leave out a leap year at the end of three centuries out of four!

If your birthday falls on February 29th, don't be afraid that you will be able to celebrate it only once in every four years...just celebrate it on February 28th in ordinary years, and have a big bash on a leap year!

Why does a rainbow appear in the sky?

A rainbow is one of the most spectacular light shows observed on earth. Poets have sung of its beauty, and you must have gasped with pleasure whenever you have seen one. But do you know what causes a rainbow?

You may have studied that light is actually made up of a collection of many colors - red, orange, yellow, green, blue, indigo and violet. If you pass light through a triangular piece of glass known as a prism, it will come out on the opposite side as a band, or spectrum, made up of these colours. Why does this happen?

The reason is that when light passes from one substance to another, it is bent slightly, and each colour is bent to a different degree. So when the colours emerge from the prism, they are separated.

This phenomenon is repeated in the rainbow. When sunlight passes through raindrops, it splits into the seven different colours of the spectrum. These are the colours that you see in the rainbow.

Rainbow

STAR FACT

10 LARGEST ISLANDS IN THE WORLD

Name	Ocean or Sea	Area (in sqkm)
1.Greenland	Arctic	2175600
2.New Guinea	W. Pacific	800000
3.Borneo	Indian	751929
4.Madagascar	Indian	587041
5.Baffin Island	Arctic	476068
6. Sumatra	Indian	467356
7.Great Britain	N. Atlantic	228300
8. Honshu	N. W. Pacific	227898
9.Ellesmere Island	Arctic	210224
10.Victoria island	Arctic	209740

There are so many mysteries in the world. Wouldn't you like to unravel some of them? In this column Manoram Tell Me Why opens the doors of mysteries for you.

How was the Rainbow Bridge formed?

The Rainbow Bridge in the Colorado Plateau of United States is the largest natural bridge in the world. It spans at a distance of 84 metres. From its base to top, the bridge towers to a height of 88 metres. And the top of the bridge with a width of 10 metres is as wide as a highway.

Rainbow Bridge

Rainbow Bridge is not only huge but also extremly beautiful. Scientists, have not yet come to agreement on how this marvellous bridge could be formed. According to legend the bridge was formed when a rainbow turned into stone. When the late afternoon sun strikes the pinkish sandstone streaked with variegated reds and brown, the effect is especially impressive like a rainbow. Visitors then can understand why the legend described it as 'rainbow turned to stone'.

The bridge is carved in a layer of sandstone that was originally deposited as wind blown dunes, and it rests on a foundation of much harder sand stone. It began to take shape some 60 million years ago, when the entire Colorado Plateau started to dome slowly but steadly upward. As the land arched up, a river that flowed across the surface in broad, meandering loops carved a canyon deeper and deeper in the rock. According to one theory at the site of the bridge it flowed in a tight curve around a thin projecting spur of rock. Eventually the river carved an opening through the base of the spur. Another theory suggests that the archway developed by rapid heating and cooling of the canyon walls in the desert climate. Bit by bit, the opening was enlarged to form today's monumental span.

Above The Surface

What was Pangaea?

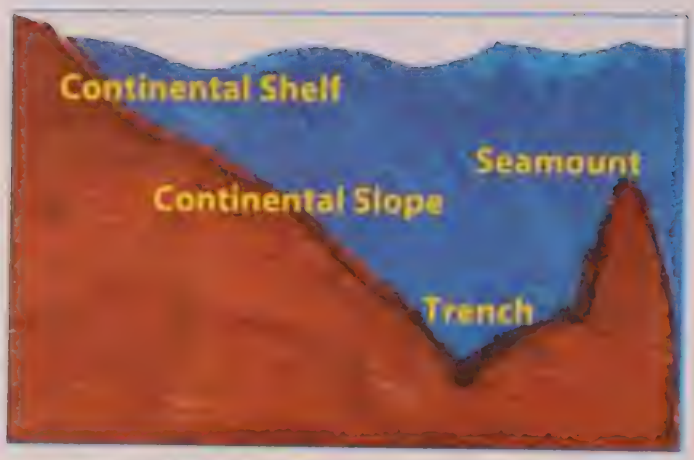
Over 250 million years ago, there was only one super continent. It was called Pangaea. The vast ocean that once surrounded the supercontinent of Pangaea has been named Panthalassa.

The shifting of the earth's crust tore the super continent apart about 180 million years ago. Large bodies of land drifted across the surface of the earth to ultimately become our present-day continents.

To understand how Pangaea was formed, we must remember that the earth itself was once just a swirling fiery mass of dust and gases that cooled very slowly. As it cooled, a crust was formed, but the inner layers called the mantle and core remained very hot. The cooling process continued, and the earth's crust was formed from heavy and light rocks. One mass of this rock formed the super continent Pangaea, which later split up into our seven continents.

Look carefully at the map of the world today. You can see that the present day continents are like pieces of a giant jigsaw puzzle. If you try to put the pieces together in your imagination, you can get an idea of what the super continent Pangaea looked like.

Pangaea



Graphic showing continental shelf

What are the continents?

The continents are the great land masses of the earth. There are seven continents on earth - Africa, Antarctica, Asia, Australia, Europe, North America, and South America. Some continents are joined to each other, and some are completely surrounded by water. Some contain a lot of countries, and some only a few. All the continents lie on top of rocky plates on the earth's crust, and are always moving very, very slowly.

STAR FACT

Trench to sink Mount Everest!

The deepest known depression on the surface of earth is the Mariana Trench, in the Pacific Ocean. Its maximum depth is 11,033 metres. The highest mountain peak on the land, Mount Everest, can dip in this Trench! The height of the Mount Everest is only 8,850 metres.

What are continental shelves?

Where a continent meets the sea, there is a broad, relatively shallow platform underwater that forms a border to the continent. This is known as a continental shelf.

The continental shelf begins at the shoreline, and slopes gradually underwater towards the deeper waters of the ocean. It usually extends to about 75 kms into the ocean.

The continental shelf may have valleys cutting across it. At the edge of the continental shelf, it becomes much steeper, as it plunges into an area known as the continental slope, or in some cases, into ocean trenches.

The continental shelves are the regions of the oceans that are the best

known, and the most exploited by man. It is this region where virtually all of the petroleum, commercial sand and gravel deposits, and fishery resources are found. Unfortunately, it is also the area where much waste is dumped!

What was Laurasia and Gondwana?

About 200 million years ago, the super continent, Pangaea began to break apart. It first broke up into two huge continents, Laurasia and Gondwana. These two continents later broke up and drifted apart to form the present day continents.

What is a peninsula?

A peninsula is a piece of land that is bordered on three or more sides by water. It comes from the Latin word 'paene insula' which means 'almost an island.' A peninsula is sometimes connected to the mainland by a narrow strip of land called an isthmus. A peninsula can also be a headland or cape.

A headland is a point of land, usually high, and with a sheer drop, extending out into a body of water. It is sometimes called a promontory. When headlands dramatically affect the ocean currents, they are often called capes.

All the continents in the world have peninsulas. In fact, the India subcontinent itself is a peninsula.

Peninsula in the south of Turkey

Maldives

How many types of islands are there?

An island is any piece of land that is completely surrounded by water, above high tide. There are two types of islands, oceanic and continental.

Continental islands were once connected to the mainland, and now lie on the continental shelf. Greenland, Great Britain and Sumatra are some examples of continental islands.

Oceanic islands emerged from volcanic vents in the ocean floor.

Mauritius

They sometimes form over volcanic hotspots. They can also occur when an oceanic rift reaches the surface. Iceland and Mauritius are some oceanic islands.

An atoll is an island formed from a

coral reef. Maldives, in the Indian Ocean, is an atoll. A key or cay is another name for a small island or islet. An island in a river or lake may be called an eyot,

There are also artificial islands. A group of islands is called an archipelago.

How many types of rivers are there?

Imagine how barren our land would be if there were no rivers! Rivers flow with peace and with power, they nourish all creatures, and they inspire us with their exquisite beauty. Rivers can be broad and placid, narrow and fast moving, winding or straight.

We all know that a river is a body of water that flows downhill in a channel, usually towards the ocean. But did you know that there are three types of rivers?

Perennial rivers are rivers that flow all the year round. They are usually found in regions where there is rain throughout the year. The melting of snow and glaciers in the spring is a source of water for many perennial rivers like the mighty Ganges.

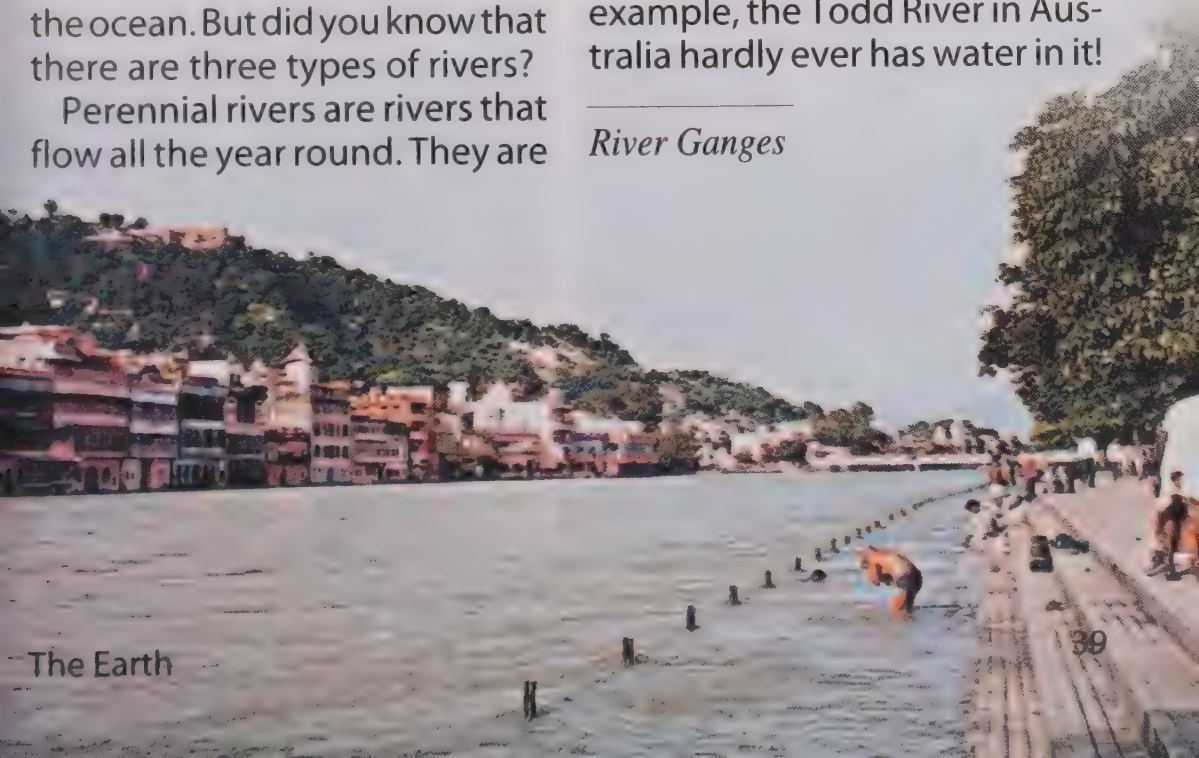
STAR FACT

The coldest place on Earth is Vostok in Antarctica. Here, the temperature can fall to a freezing -89°c

Seasonal rivers flow only during the wet season. Many Mediterranean countries have seasonal rivers that flow in the wet season, but are dry in summer.

Do you know there are also rivers that are dry? They are called Ephemeral Rivers. Many desert rivers are ephemeral...for example, the Todd River in Australia hardly ever has water in it!

River Ganges



A Glacier

Where do you find rivers of ice?

Glaciers are rivers of ice that move very slowly. They can take a year to move as far as you can walk in a few minutes. When a piece of a glacier breaks off and floats in the water, it's called an iceberg.

Glaciers form high in mountain valleys and in polar regions where the snow falls, but never melts. The heavy snow crushes the layers below into ice, which starts to slide slowly downhill as a glacier.

As the glacier moves slowly down the mountain, it grinds against the ground and the walls of the valley to make it deep and wide. Glaciers cover about six million square miles which is about three percent of the earth's surface.

How does a river change?

If you were to journey down a river from its source, you will find it changes quite a bit as it flows towards the ocean. A river always flows downwards from highland areas to lowland areas, through an upper, middle, and finally lower course.

The upper course of a river is close to its source. It tumbles through mountain gorges forming waterfalls and rapids. It is very fast and very powerful as it carries away rocks, making valleys deeper and wider.

Todd river in Australia

Once it enters the plains, the river slows down for its middle course. It flows in smooth chan-

nels made from its own deposted material, and will start meandering. Tributaries join the river, and it starts winding across the valley in loops and twists.

As the river nears the ocean and enters its lower course, it becomes even broader and slower. At its end, or mouth, it may drop more sediment and split into little branches to form a delta. The mouth of the river, where it finally joins the sea is its estuary.

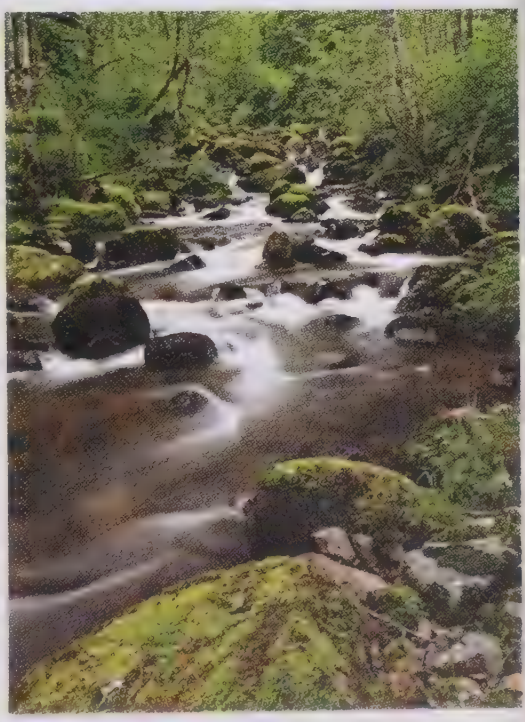
So, we see that as a river travels along its course, both the river and the landscape around it changes. On the one hand, the nature of landscape affects the river's course and flow.

Why does a river run?

If you watch a river, you will notice that it is always moving. Have you wondered what makes a river run?

The answer in one word is – rain. Rain does not always run directly off the land into the river. Sometimes it sinks into the ground, to come out again lower down in the course of the river through holes called springs. Rain is also frozen into snow, and when the snow melts, it makes the river run even faster.

So without rain, every river will stop running. The more it rains, the fuller the river will be, and the faster it will run. Of course, too much rain can cause the river to flood too. Floods usually happen after heavy rains, or when the winter snow melts in spring.



Tributary of a river

Where do rivers run the fastest?

A swiftly flowing stream leaping over rocks and rushing downhill certainly seems to be moving faster than a river flowing calmly over flat ground. However, the interesting fact is that on the lower course of a river, there are less obstacles and less friction. Since the river can flow more smoothly here, it can also flow faster!

Why do rivers wind?

As a river nears the sea, it starts to twist and turn in horseshoe shapes called meanders. Some rivers meander more dramatically than others. Do you know why this happens?

When a river enters the plains and encounters an obstacle, it is moving more slowly than before, and may simply curve around it. As the river flows around this bend, the current becomes strongest at the outside of the curve. This increased rate of flow encourages erosion, and tends to pick up river bottom and soil from the bank and move it downstream.

The current on the inside of the bend is slower and deposits gravel, sand and other solids. As the erosion on the outside of the bend continues to occur, the deposits of materials on the inside of the bend also continues. This forms a meander, or twist in a river.

Meander

Where do rivers start and end?

Rivers are born high in the mountains where rain water or melting snow collects and forms tiny streams. These streams join together as they flow downhill. As more streams join the flow, the river becomes bigger and wider.

Once it reaches the plains, rivers slow down. They start twisting and turning, forming meanders. As they near the end of their journey they may split into small channels again, before they finally merge with the waters of the ocean.

How do rivers shape the land?

Rivers play an important role in shaping the land. Running water wears away the land over thousands of years. This wearing away forms deep valleys along the river bed. As the river twists and turns, the valleys become wider. In time, these valleys become broad plains.

Rivers also build plains by depositing sediment and silt carried down from the mountains. So, we see that rivers shape the land both by the wearing down and building up process.

Jordan river entering into the sea

Did you know that rivers can cut through mountains? Indeed, the Indus River has cut its way through the Himalayas, showing that water is a tremendously powerful force.

Niagara Falls

What is a waterfall?

Waterfalls are one of the most breathtaking sights on earth. As a river plunges over a ledge of rock, it thunders downwards in a plume of frothy white, to splash down amidst glittering spray, before continuing on its journey.

Waterfalls usually occur where the river flows over a band of hard rock. The rushing water wears away the softer material on the surface, leaving the harder layer below untouched. Waterfalls are seen where a river bed drops abruptly and nearly vertically.

A waterfall may also be termed a falls. When large volumes of water are involved it may called a cataract. Waterfalls of small height and less steepness, or a series of small falls are called cascades. Still gentler stretches of river that exhibit turbulent flow and white water are called rapids.

The highest waterfall in the world is Angel Falls in Venezuela, which plunges almost 960 metres down.

Other famous waterfalls are the Niagara Falls on the border

between the United States and Canada, and the Victoria Falls in Africa.

How do waterfalls form?

Waterfalls can be formed in different ways. Some, like the waterfalls in Yosemite National Park in America, are formed by the action of glaciers. A large glacier is fed by smaller glaciers, and the valleys of the smaller glaciers will not be as deep as that of the large glacier. So, when the glaciers melt, rivers running along the channels created by the smaller glaciers have to plunge downwards to enter the main river, creating waterfalls.

In other places, waterfalls are formed by alternating layers of softer and harder rock. This means that the weaker rock downstream will wear away faster than the harder rock upstream. The river bed becomes lower downstream, and the river will have to plunge over a steep cliff, forming a water fall.

Many waterfalls also occur where rivers flow over hard rocks which overlie softer ones. The hard rocks resist erosion, while the softer rocks are worn away.

Angel Falls

The hard lip of the waterfall often overhangs the softer rocks and sends the river cascading downwards.

How do rivers move silt and sand?

We know that water is one of the most powerful agents of erosion. The rushing waters of a river wear away rock, and carry away rocks, sand and silt on its journey to the sea. The bigger rocks and pebbles roll along the river bed, while the smaller ones bounce along. The lighter grains of sand and silt float in the water, until they are deposited further downstream.

What happens to the silt in a river?

The fine particles of soil and rock carried downstream by a river are called silt. The faster a river flows, the more silt it carries along. During a flood, the amount of silt that is carried by the river increases tremendously. When the river overflows its banks, the flood waters will fill the land on either side. When the flood subsides, the flood waters will recede, leaving the surrounding land covered with silt.

Did you know the Huang He or Yellow River(pictured above), in China, got its name because of the yellow colour of water, that is caused by the silt it carries?

How does land shapes river?

We know that rivers shape the land by forming deep valleys in the mountains and broad plains in its lower course. Rivers, in turn, are also shaped by the land.

In the highlands, the streams follow the contours of the land, and the streams run swiftly as they flow downhill. When the river reaches the more gentle slopes, it becomes wider and slower. Mud and sand is deposited when the river floods, and these form alluvial plains and mud banks.

As the river nears the sea, it splits into several channels. These channels may be permanent, or they may change with every flood. The mouths of these rivers are known as deltas. They, in turn influence the flow of river.

Hills and mountains, forests and other vegetation, and even man made structures like dams can all shape a river.

The Alps

How are mountains formed?

Mountains are created over long periods of time by tremendous forces in the earth. Mountains are formed by volcanism, erosion, and disturbances in the earth's crust.

The earth's crust is made up of huge slabs called plates, which fit together like a jigsaw puzzle. When two slabs of the earth's crust smash into each other, the land can be pushed upwards or folded forming mountains. Many of the greatest mountain ranges of the world have formed because of enormous collisions between continents that rest on the plates. Some really complex folds can be found in parts of the Alps, Himalayas, Appalachians, and Russia's Ural Mountains.

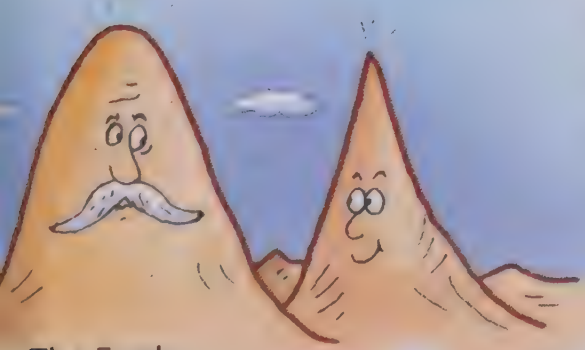
Volcanic mountains are mountains that form when molten rock erupts onto the earth's surface. They can either form on land or in the ocean.

Domed mountains, like those in the Black Hills of South Dakota, and the Adirondack Mountains of New York, are an unusual type of mountain that is formed when molten rock rises through the crust and push up the rock layers above it.

Did you know that mountains can form under the sea, and some islands are the tops of these mountains?

Do mountins shrink?

It is difficult to think of a huge mountain shrinking. But the fact is that mountains are being constantly worn away by wind, rain, frost and ice. This is why young mountains have sharp peaks, and old mountains have smoother, rounder tops.



The Earth

Why are some mountains capped with snow?

You must have seen lots of pictures of mountains that are capped with snow. Do you know why the snow does not melt even in summer?

The reason is that as you go higher and higher, the air gets colder and colder. After a certain height, the air is always so cold that even in summer the snow will not melt. This level is called the snowline.

Below the snowline, it is warmer, and trees and plants can grow. Animals that live above the snowline have thick woolly coats for warmth.

Near the equator, the snowline is 4800 metres...that is, after 4800 metres, the air is so cold that snow on a mountain will not melt. In colder climates, the snowline is at 2670 metres...and at the poles, it is at sea level. This means that the snow never melts even in summer at the Poles.

What is a mountain range?

Mountain ranges are groups of mountains that lie side by side. Their lower slopes join to form a continuous high land, but their peaks are separate. Mountain ranges are usually separated from other mountain ranges by passes and rivers.

The Himalayas

The Andes Mountains, which stretch more than 7200 kilometres through seven South American countries, form the longest mountain range in the world, and the Himalayas are the highest mountain range in the world.

The Andes

What are Fold Mountains?

Fold mountains are mountains formed from the folding of the earth's crust. Fold mountains are usually formed from sedimentary rocks. These rocks are formed from sediments that have slowly accumulated, layer by layer, over millions of years. The layers may be several kilometres long, and are usually found along the edges continents.

We know that the continents rest on plates, and that these plates are floating on a layer of molten magma that lies beneath them. When the plates and the continents riding on them collide, the accumulated layers of rock crumple, and fold like a tablecloth that is pushed across a table, forming Fold mountains.

There are two types of Fold mountains - young Fold mountains that are 10 to 25 million years of age like the Rockies and Himalayas and old Fold mountains which are over 200 million years of age, like the Urals and Appalachians of the USA.

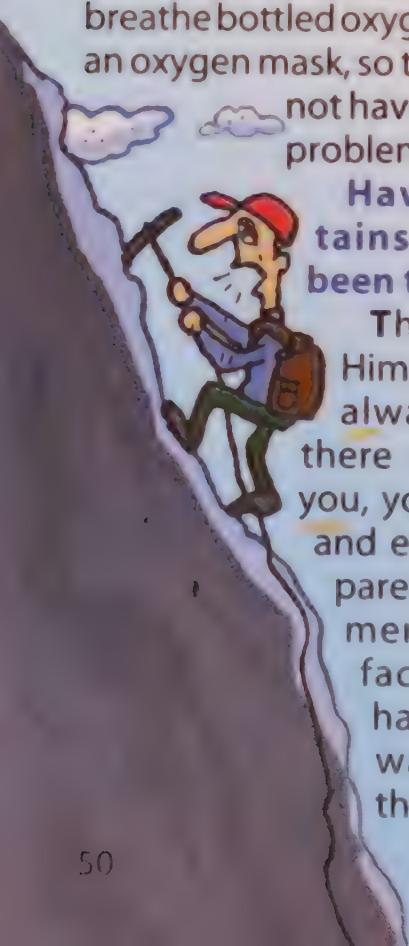
Why is it cold on top of the mountains even though it is nearer the sun?

When you climb a mountain, you will find the air getting colder and colder. This is because there is less air pushing downwards as we go higher. As a result, the pressure drops, and the air thins out and expands. This expansion cools the air. So mountain tops are cold isolated places, and people climbing mountains must take care to wear warm clothing for protection against the cold.

Can you breathe on top of a mountain?

If you are climbing a very high mountain, you will not only feel colder as you climb, you will also find it more difficult to breathe. This is because there is very little oxygen in the air once you are more than 1500 metres high.

As you go higher and higher, you will find that you are getting more and more tired, and that you are climbing more and more slowly. Some climbers in fact, sit down to rest, fall asleep and die! So, it is important that climbers of very high mountains breathe bottled oxygen through an oxygen mask, so that they do not have breathing problems.



Have mountains always been there?

Though the Himalayas have always been there as long as you, your parents and even grandparents can remember, the fact is they have not always been there.

Mountaineering

Most of the world's mountains were formed quite recently in the earth's history. When you consider that the earth came into existence about 4.5 billion years ago and that the Himalayas were formed only 40 million years ago, we can say that they are quite young mountains!

So the answer to the question is...no, mounatins have not always been there. Different mountains were formed during different peiods in the earth's history, so mountains are not 'eternal' as we would like to believe!

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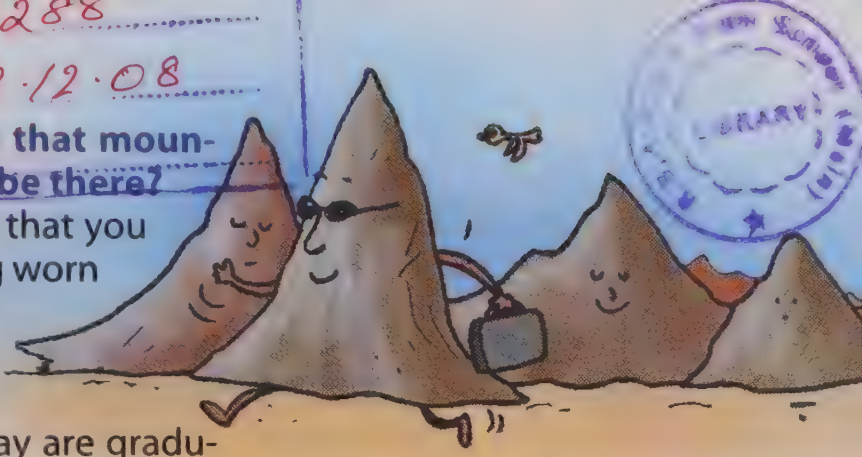


Why do we say that mountains will always be there?

Every mountain that you see is slowly being worn away by wind and water, ice and frost. All the mountains of today are gradually getting smaller and flatter. Did you know that some parts of the world that are now flat were once mountains?

But the other side of the picture is that new mountains will also be formed by the movement of the earth's crust and forces within the earth. In fact, the Himalayas are still growing, so we can hope they will be around for a long, long time!

Where do mountains form?

Many of earth's mountain ranges are located along the boundaries of plates, or former plate boundaries. You will find them along the edges of continents, for they have been formed as the continents collided and crumbled.

Mountains are also formed along rifts in earth's crust like the East African Rift, and along mid-ocean ridges. Most of the mountains along mid-ocean ridges are underwater, but a few volcanoes along these ridges rise above sea level.

Volcanic hot spots, and fault lines in the earth's crust produce mountains too.

The Rockies

When did moutains form?

It is difficult to specify a specific time when mountains formed. They gradually appeared on different parts of the earth during different periods of times.

We can, however, safely say that most of today's mountain ranges were formed in the last 50 million years...and mountains are still being formed in different parts of the world.

UNEXPLORED REACHES OF OUR EARTH

Although modern methods of communication have made the world a much smaller place, can you believe that it still has some unique places, untouched by our civilization, where nature still rules?

THE AMAZON BASIN

The Amazon river basin, in northern Brazil, is the largest river basin in the tropical world. The area abounds in dense tropical jungles, and is the most biologically diverse region in the world. Pink dolphins, jaguars, tapirs, caiman crocodiles and giant anaconda snakes share the region with many indigenous Indian tribes that are spread throughout the jungle, living as they have done for thousands of years. Few explorers have dared to penetrate these forests, and some have even been lost on short trips.

Amazon jungle

ANTARCTICA

A permanent blanket of ice always covers the large Antarctic continent. Explorers and scientists of many nations have crisscrossed this mysterious, icy cold land since the signing of the Antarctic Treaty in 1959. However, not all the surface terrain has been seen, or reached by men on the ground. Though some of the mountainous regions have been photographed from the air, man has never approached them. The bedrock terrain that lies under the Antarctic ice sheet still remains largely unknown to man.

GREENLAND

Greenland is the largest island in the world. It is owned by Denmark, and its ice-sheet covers 1,833,900 square kilometres, which is 85%of Greenland's total area, and represents 10% of the world's total fresh-water reserves! Scientists still do not know not what lies under the ice in Greenland.

HIMALAYAS

The serene and mysterious Himalaya Mountains, characterized by soaring heights, stupendous glaciers and steep-sided jagged peaks, are still largely unconquered by mankind. The mighty range is full of valuable resources, which are, as yet, inaccessible because of the icy and inhospitable terrain. Hundreds of peaks remain unexplored, awaiting future generations of lion hearted mountaineers.

THE ARCTIC

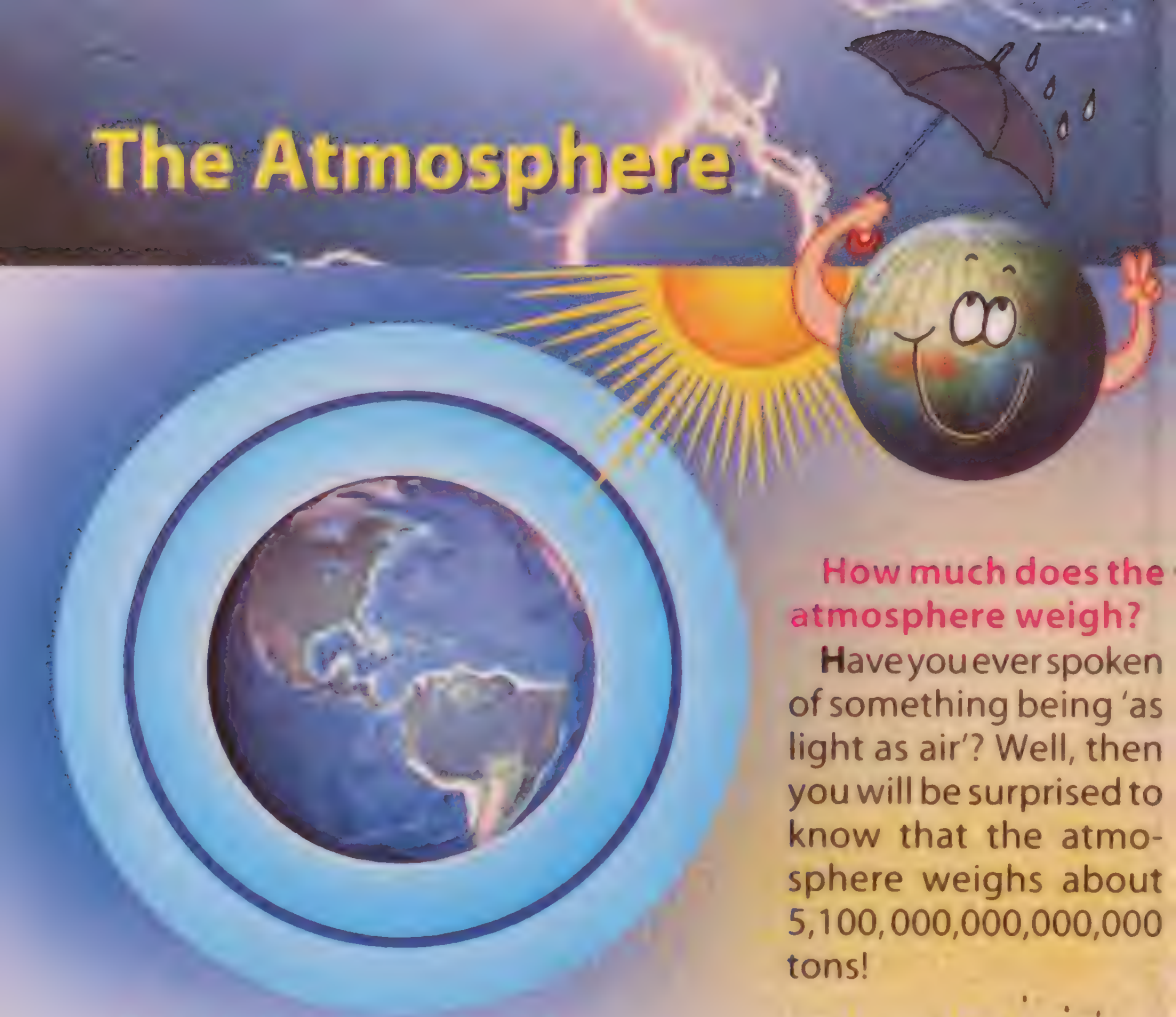
The Arctic Ocean is one of the most unexplored and untouched ecosystems on earth. Aeroplanes have flown over most of the far north of this freezing cold destination, and it is laced with a network of radar warning stations served by military and technical personnel. However, the Arctic has still not yielded most of its secrets to scientists, and there are still blank spaces on the map of this region, that man has no knowledge of.

NEW GUINEA

Papua New Guinea, is the biggest island in the Pacific. Overflowing rivers, steep gorges, humid jungles and high mountains have made normal movement impossible. So this exquisite and untamed land is still untouched by the chaos of modern life.

Explorers in Papua New Guinea

The Atmosphere



What is the atmosphere?

Our planet earth is wrapped in a thin layer of gases that we call the atmosphere. It plays a vital role in making our planet suitable for life. It gives us air to breathe, and water to drink. The atmosphere also warms the earth, and at the same time, shields us from the sun's harmful rays.

The atmosphere is like a blanket that is hardly thicker on the earth than the skin of an orange. It gets thinner and thinner as its distance from the surface of the earth increases. About 1000 kms above the earth, it fades away completely, and then there is nothing but space.

How much does the atmosphere weigh?

Have you ever spoken of something being 'as light as air'? Well, then you will be surprised to know that the atmosphere weighs about 5,100,000,000,000,000 tons!

This means that something like a ton of air is pressing down on you at this very moment. Yet, you are unaware of it. The reason is that our bodies are made to live under this pressure.

Air is heaviest at sea level because the air molecules are compressed by the weight of overlaying air. It becomes thinner and lighter as one goes higher. This is why aircraft cabins are pressurized. Otherwise, as the plane flew higher, the pressure would become less, you would find it difficult to breathe.

Which gases are contained in the atmosphere?

The atmosphere is a mixture of gases, which together, make up the air we breathe. The most abundant gas in atmosphere is nitrogen. It makes up 78% of the atmosphere.

Oxygen, which is so important in supporting life, forms 20% of the atmosphere. Carbon dioxide which is essential for plants to breathe forms only a fraction of the atmosphere.

The remainder of the atmosphere is made up of traces of other gases like argon, neon, helium, krypton, methane, nitrous oxide and hydrogen.

About 25 kms above the earth there is a layer of a gas called ozone. This layer absorbs a great deal of the harmful rays of the sun.

The atmosphere also contains a considerable amount of water vapour. It is formed by the evaporaation from oceans, lakes and rivers.

What does the atmosphere do?

We cannot see the atmosphere, we cannot feel it pressing down upon us. Yet, without the atmosphere there would be no life on earth.

The atmosphere contains oxygen for us to breathe, and carbon dioxide for plants to breathe. At the same time, it acts like a glass shield above us, letting in sunlight for things to grow, but blocking out the harmful rays of the sun. It allows the sun's rays to warm the earth during the day. At night, it traps the warmth on the surface, so that it escapes more slowly into space. Without the atmosphere, temperatures would be extreme on the surface of the earth.

The changes in the atmosphere are responsible for changes in the weather. The water vapour present in the air condenses to bless us with life-giving rain. Without the atmosphere, there would be no clouds, no wind, and no rain at all.

The atmosphere also protects us from meteorites that fall steadily from space. Did you know that millions of them hit the atmosphere every day? When they come into contact with air, friction reduces most of them to gas and dust. Only very few exceptionally large ones sur-

vive the journey through the atmosphere to actually strike the surface of the earth.

The atmosphere gives us the beautiful blue of the sky. Tiny molecules of gases and dust particles break up sunlight into the seven colours which make light. Of these, blue is the colour that is scattered more, and so the sky looks blue. In the morning and evening, the distance that the light has to travel from the sun to an observer is at its greatest. This means a large amount of blue and violet light has been scattered so the light that is recieved by an observer is mostly red. When there is moisture in the air after rain, particles of moisture break up the sunlight to give us a breathtaking rainbow with its seven colours!

The Earth

Has the earth's atmosphere always remained the same?

Like everything else on earth, the atmosphere has changed a lot compared to the earth's early atmosphere. When the earth was first formed, 4500 million years ago, the atmosphere was made up mainly of hydrogen and carbon dioxide. Since hydrogen is very light, most of it spread out in space and the carbon dioxide became locked up in rocks.

Once plants appeared on earth, perhaps 2.7 billion years ago, they began to remake the atmosphere. The air now contained oxygen too, and ever since then, life and earth's atmosphere have waltzed together. However, for the last billion years the atmosphere has remained pretty constant.

What is atmospheric pressure?

If you take an empty bottle, close it, weigh it, pump out the air in it, and weigh it again, you will find that the bottle weighs less than before. This proves that though you cannot see or feel air, air has weight.

Atmospheric pressure is the force exerted on you by the weight of tiny particles of air molecules. Although air molecules are invisible, they still have weight, and take up space. Since there's a lot of 'empty' space between air molecules, air can be compressed to fit in a smaller volume. When it's compressed, air is said to be 'under high pressure'.

Air at sea level is what we're used to - in fact, we're so used to it that we forget we're actually feeling air pressure all the time!

Did you know that the earth's atmosphere is pressing against each square inch of you with a force of 1 kilogramme per square centimetre? It's because you have air inside your body too, that air balances out the pressure outside, so you stay nice and firm and are not squashed!

If you've ever been to the top of a tall mountain, you may have noticed that your ears pop and you need to breathe more often than when you're at sea level. This is because the air gets thinner as you go higher, and as the number of molecules of air around you decreases, the air pressure decreases.

Weather forecasters measure air pressure with a barometer. It

Brass barometer

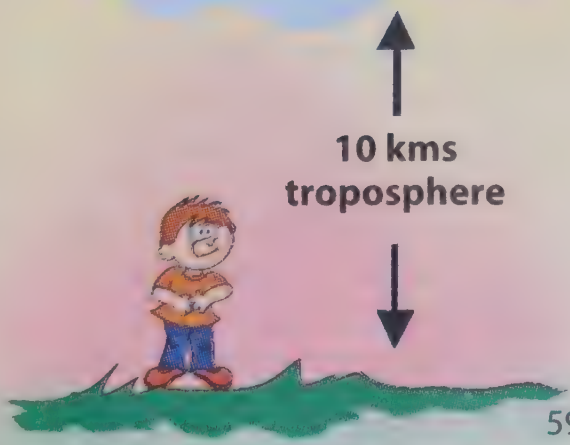
Toricelli

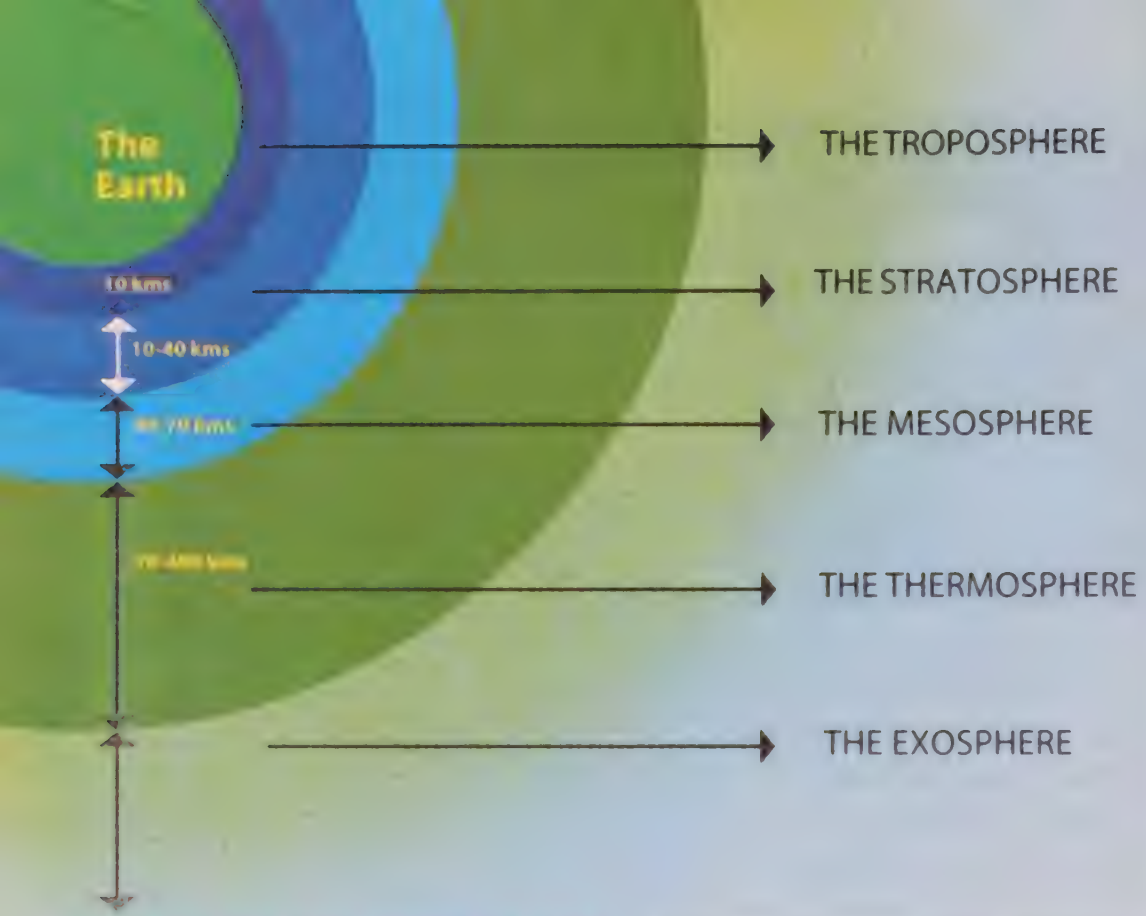
was an Italian scientist called Torricelli who designed an apparatus on which the barometer is based. Barometers are used to measure the current air pressure at a particular location in 'inches of mercury' or in 'millibars'. A measurement of 29.92 inches of mercury is equivalent to 1013.25 millibars.

Air pressure can tell us about what kind of weather to expect as well. If a high pressure system is on its way, often you can expect clear skies. If a low pressure system is coming, then expect storms and rain!

Why is the troposphere different?

The troposphere is the layer of atmosphere that is closest to the earth's surface. It extends only about 10 kms above the surface of the earth, and so takes up only 1.5% of the total space in the atmosphere. However, the other layers lying on top of the troposphere make it so dense that it contains over 80% of the atmosphere's total mass!





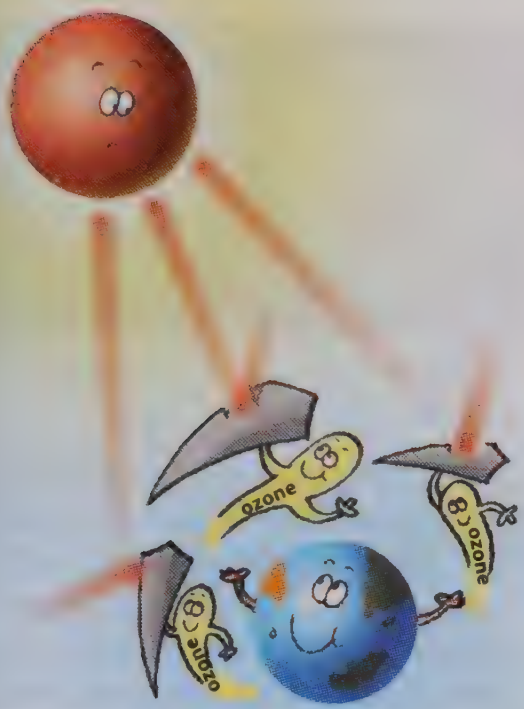
What are the layers of the atmosphere?

The atmosphere is divided into five layers. It is thickest near the surface, and thins out with height until it eventually merges with space.

The troposphere is the first layer above the surface and contains half of the earth's atmosphere. It is the densest part of the atmosphere, and there is maximum amount of water vapour and carbon dioxide in this layer. It is heated by the ground, and is responsible for the weather.

The stratosphere is less dense than the troposphere. It extends from 10 to 40 kms above the earth's surface. It contains almost the same gases, but there is much less water vapour here. The stratosphere contains a layer of ozone, which absorbs most of the harmful rays of the sun. Many jet aircrafts fly in the stratosphere because it is very stable.

The mesosphere is the next layer. It extends between 40 and 70 kms above the earth's surface. The gases are even less dense here, and there is almost no carbon dioxide or water vapour. It is important in that meteors burn



up on their way to the surface in the mesosphere.

The fourth layer is the thermosphere. It extends about 400 kms into space. Its thin gases trap radiation from the sun, making it extremely hot.

The atmosphere merges into space in the extremely thin fifth layer- the exosphere. This is the upper limit of our atmosphere. Beyond it, is the emptiness of space.

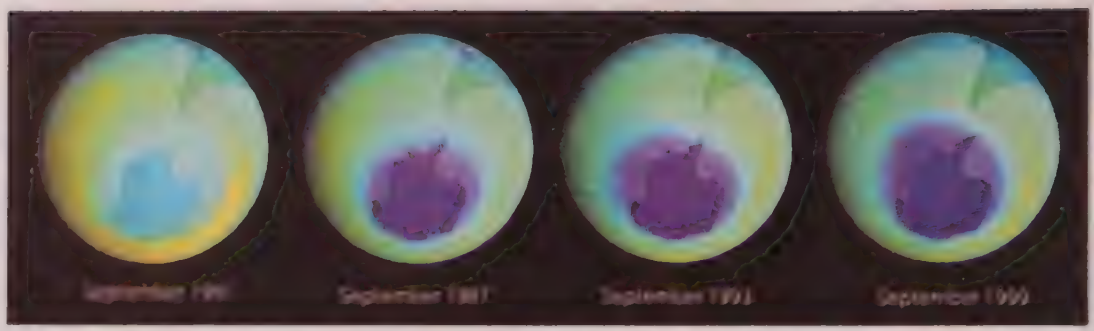
What is ozone?

Oxygen exists in the form of molecules, and each molecule of oxygen contains two atoms of oxygen. There is, however, another form of oxygen called ozone, which is made up of three oxygen atoms.

Most ozone is formed in the upper layers of the atmosphere, by the ultraviolet radiation emitted by the sun. The radiation breaks up the oxygen molecules into separate atoms. When these single atoms become attached to another oxygen molecule, an ozone molecule is formed. Ozone can also be formed when lightning splits up oxygen molecules.

Ozone is found in a layer about 19 to 35 kms above the earth. This is called the ozone layer. It is very important to us because it filters and protects us from the sun's ultraviolet radiation. Since it kills germs, it is used to purify water, and as a cleansing agent.

Though the effects of ozone in the upper atmosphere are essential to the survival of life on earth, if there is too much ozone near the surface, it can be harmful to plants and animals. Breathing in too much ozone can harm the tissue of our lungs.



Ozone hole during different periods of time

What is an ozone hole?

Small amounts of ozone are constantly being made in the stratosphere by the action of sunlight on oxygen. At the same time, ozone is being broken down by natural processes.

The ozone-destroying reactions take place most rapidly only under certain conditions in the stratosphere. These conditions – extreme cold, darkness and isolation, followed by exposure to light – occur over the polar regions after the long polar winter has finished and the first spring sun appears.

STAR FACT

Amazing Antarctica!

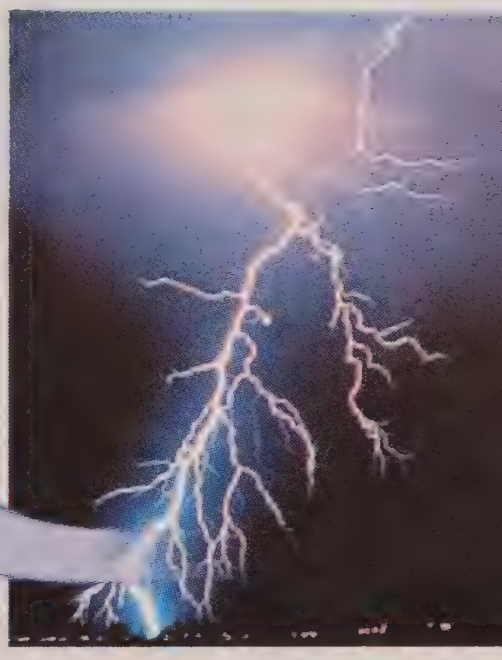
Antarctica is the coldest place on earth. Its freezing air tends to be extremely dry because very cold air holds only a small amount of water vapour.

Antarctica is the worst affected area, probably because the air above it is most isolated from the rest of the atmosphere. Scientists often refer to the part of the atmosphere where ozone is most depleted as the 'ozone hole', but it is not really a hole – just a vast region of the upper atmosphere where there is less ozone than elsewhere

The total amount of ozone usually stays constant, because its formation and destruction occur at about the same rate. Human activity has recently changed that natural balance. Certain manufactured substances can destroy stratospheric ozone much faster than it is formed.

We know that it is the ozone layer that protects us from the sun's ultraviolet radiation. Even a 1 percent reduction in the amount of ozone in the upper atmosphere causes a measur-

able increase in the ultraviolet radiation that reaches the earth's surface. If the ozone layer is destroyed, the amount of ultraviolet radiation reaching us would be catastrophically high, and all living things would suffer radiation burns. So, it is very important to prevent too much ozone from being destroyed, and ozone holes from forming.



What is weather?

Weather is an important part of our lives, and one that we cannot control. Instead, the weather often controls how and where we live, what we do, what we wear and what we eat. So what is exactly weather?

Weather is the day-to-day conditions of the air in a particular place. It can change from day to day. For example, it might have been sunny yesterday, but today may be a rainy day. On some days it can be windy, on other days the weather can be hot and humid.

People sometimes mix up climate and weather, but the two are quite different. The climate is the common, average weather conditions at a particular place over a long period. There are many different types of climates around the world. Deserts have a hot and dry climate while the Antarctic has a very cold and dry climate.

How does the weather start?

The weather starts in the atmosphere. In cold regions, the cold air is heavier than warm air, so it sinks to the ground. As it sinks, it starts spinning and moving across the earth as wind. When it reaches warmer regions, it is sucked up again as warm air rises up. Air rising from warm regions goes back to the polar regions, where it becomes cold, and sinks to the earth once again.

So we can say that differences in temperature on different parts of the earth set in motion a restless movement of air in great swirling, churning currents. It is this movement that is responsible for the weather.

How do we forecast the weather?

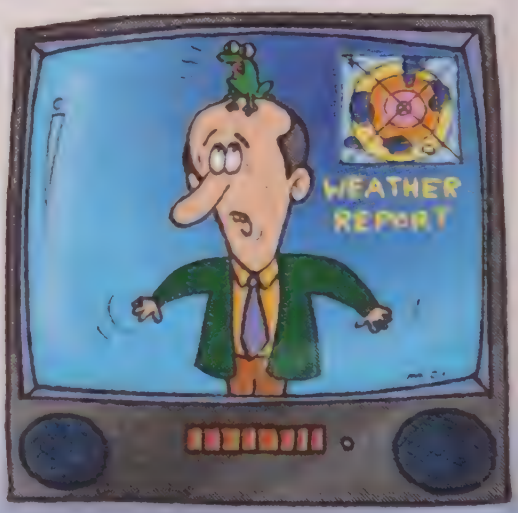
Weather forecasting is a prediction of what the weather will be like in an hour, tomorrow, or next week. Modern forecasting involves technology, science, and advanced math to accurately predict the weather.

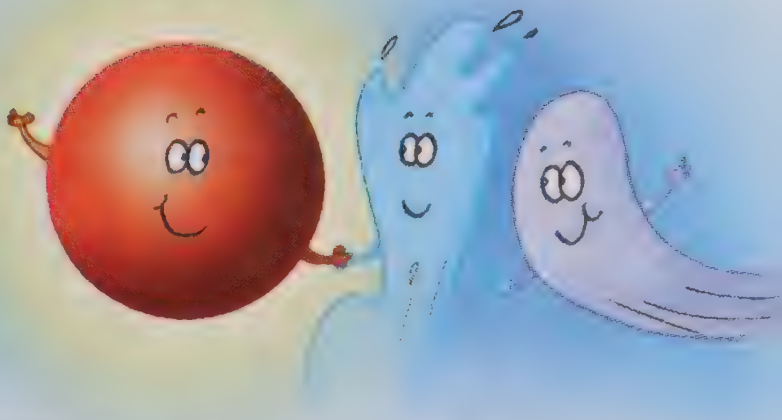
The first step in weather forecasting is to get information about the weather, or weather data. Data is collected from the atmosphere from launching balloons twice a day all around the world. Weather balloons

Metsat

record data such as temperature, pressure, humidity, and wind speed at different heights in the atmosphere

Another useful tool for forecasters is satellite technology. Satellites allow meteorologists to see what the earth and clouds look like from space. This way, forecasters can see how the atmosphere is behaving.





The data from weather balloons and satellites is put onto maps by computers. These computers can make forecasts based on certain conditions, and mark them on the weather maps. Meteorologists read the weather maps, and by interpreting the data that appears on them, they are able to make a forecast.

What are the three ingredients of weather?

The sun, wind and water are the three main ingredients of weather. The sun warms the earth and supplies the energy that drives the winds.

The sun's energy is absorbed by land and water. They radiate much of it back as heat. The sun also causes evaporation of water into the air to form clouds, which bring us rain.

Winds blowing from the sea to the land can cool it and bring rain. Winds blowing from the land to the sea will make the weather dry.

Water also plays a vital part in our weather. Water from our rivers, seas and lakes evaporates and turns into water vapour. Warm water vapour rises and as it turns colder in the higher levels of the atmosphere it condenses and falls back to earth as rain or snow. The rain and melted snow flow into rivers, lakes and seas, completing the water cycle.

Weather radar

A meteorology station in Australia

What is meteorology?

Meteorology is the science that studies atmospheric phenomena, especially those that relate to weather.

Meteorolgists are scientists who forecast the weather. They rely on thousands of weather stations located around the world, both on land and at sea. At each station, measurements are taken of such things as air pressure and temperature, wind speed, cloud cover, and precipitation. Elsewhere, upper-level observations are made by weather balloons, and satellites, which send a continuous flow of photographs back to earth.

All of this information is sent to national weather centres where it is plotted on charts and analyzed by meteorologists. This information, called a forecast is then sent to the public by newspapers, radio and television.

Man has always been dependent on the weather, whether it is for farming, industry, fishing flying, shipping or many other activities. So we can say that meteorologists play a very important role in our lives.

Forces of the Earth

What is an earthquake?

An earthquake is a trembling or a shaking movement of the earth's surface. We know that the surface of the earth or its crust is split into tectonic plates that are floating on a layer of molten magma which lies beneath them. When these plates collide or pull apart, the earth shakes and trembles

Can we predict earthquakes?

To some extent, it is possible. Scientists have developed sensitive instruments which can detect small movements of the earth's crust and the build up of stress in rocks.

Damage caused by an earthquake in Gujarat, in 2001

Scientists have also looked at natural warning signals including weird animal behaviour, and changes in the water table, stream flow, well levels, and patterns of electrical currents in the ground. Yet, to date, nobody has been able to predict earthquakes reliably enough to allow people to be evacuated from cities threatened by a quake.

In Japan, people thought earthquakes were caused by a giant catfish wriggling about on the sea bed. The gods had to put a rock on the fish's head to make it stay still!

How deep do earthquakes go?

Earthquakes occur in the earth's crust or upper mantle. Most earthquakes occur at depths of about 25 km.

The centre or source of the earthquake is known as the focus. The surface region directly above the focus is known as the epicentre.

Earthquakes that have their focus at depths up to 70 kms, are known as shallow focus earthquakes. Those that have their focus at depths between 70 to 300 kms are intermediate focus earthquakes, and those that have their focus at depths between 300 and 700 kms are deep focus earthquakes.

Generally speaking, the deeper the focus of the earthquake, the rarer it is, and the greater the damage it will cause. Most deep focus earthquakes occur in what is known as the circum-Pacific belt.

What is a volcano?

A volcano is an opening in the earth's surface or crust, which allows hot, molten rock, ash and gases to erupt from deep below the surface. Over a period of time, the hot molten rock that has poured out, cools to form a mountain around the opening. When a volcano erupts, it will destroy everything for miles around.

Volcanoes that keep on erupting are active volcanoes. Those that have not erupted for many years are dormant volcanoes. Volcanoes that haven't erupted for millions of years and are unlikey to erupt again are extinct volcanoes.

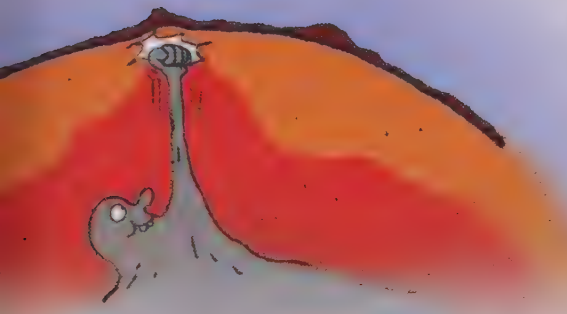
Where do most earthquakes occur?

Did you know that in Japan earthquakes occur almost daily? Of course, they are very mild, and do not do any damage. Another place that has frequent earthquakes is the Mediterranean region.

An erupting volcano

Why do some places have frequent earthquakes?

The reason is that the earth's crust is not the same everywhere. In some places, there are cracks or faults in the rocky plates that form the crust of the earth. Where such a fault exists, one rock may rub against the other, causing vibrations. These vibrations travel thousands of kms as an earthquake.



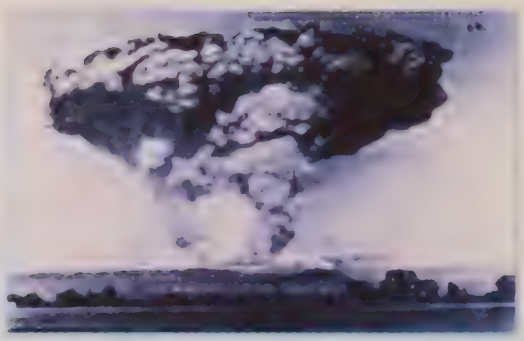
Why do volcanoes appear only in some places?

Most of us in India will never see a volcano in our lifetime. This is because volcanoes form only in certain places.

Volcanoes form only in places where the earth's crust is weak. Such weak spots are usually found where the edges of the tectonic plates meet. When the plates move, the melted rock and gases from deep inside the earth find the weak spots, and gush out with tremendous force.

Such weak spots occur in Central America, bordering the Pacific Ocean. Two thirds of the world's active volcanoes have been found in this area, which is called the 'Ring of Fire.' The volcanoes around Hawaii, however, are not created by a tectonic plate, but hot spots. Hot spots are places where the layer below the earth's crust, known as the mantle, is so hot that it causes magma to bubble and move to the surface in a column called a mantle plume.

Ring of Fire



Lassen Peak volcano eruption in 1915

Do volcanoes have different shapes?

Indeed they do! The differences arise from the way they are made, the type of lava and the kind of volcanic material. The most common are the shield, the dome, the cinder cone and the strato volcano.

Shield volcanoes are the type found in Hawaii. They are shaped like wide, sloping mounds. The lava from shield volcanoes is liquid and flows from the crater and the sides of the volcano.

The most dangerous volcanoes are the dome volcanoes. The volcano in Lassen Peak, California, is a dome volcano that erupted in 1915. The lava from dome volcanoes is thick lava that forms cones shaped like steep domes.

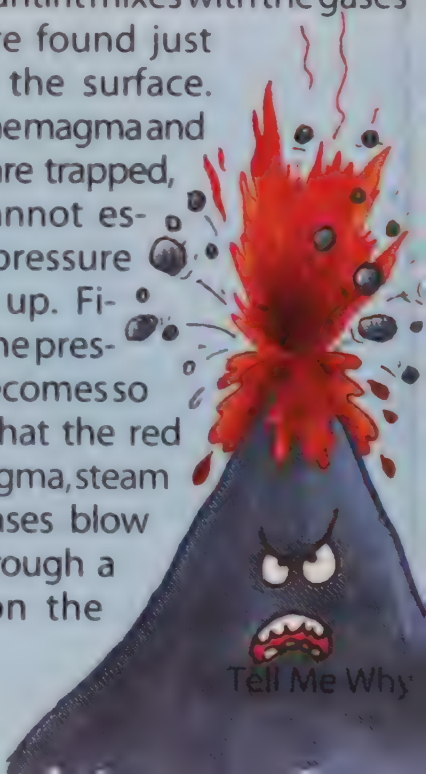
The cinder cone volcanoes can be explosive also. Their cones are formed from cinders, which are small, jagged pieces of rock and ash. The Paricutin volcano in Mexico is a cinder cone volcano.

Most volcanoes are stratovolcanoes. They are more active than shield volcanoes, but not as explosive as the cinder cone or the dome volcanoes. Mount Fuji in Japan is a stratovolcano.

So, we see that volcanoes come in different sizes and shapes. Many volcanoes are shaped like cones. Others are like long cracks in the earth's crust. Some are very small and very steep. Some are huge...but all can cause great damage if they erupt!

Why do volcanoes erupt?

We know that underneath the surface of the earth is a layer of molten rock called magma. This magma is so hot that it keeps rising, until it mixes with the gases that are found just below the surface. Since the magma and gases are trapped, and cannot escape, pressure builds up. Finally, the pressure becomes so great that the red hot magma, steam and gases blow out through a vent on the



Mount Fuji

top or side of a mountain, and the volcano erupts.

Volcanic eruptions can also be accompanied by earthquakes, floods, hot ash flows and tidal waves, which can often prove even more devastating than the actual eruption.

Where do volcanoes form?

To put it simply, volcanoes form where the earth crust is cracked or very thin. They can form both on land and on the sea bed.

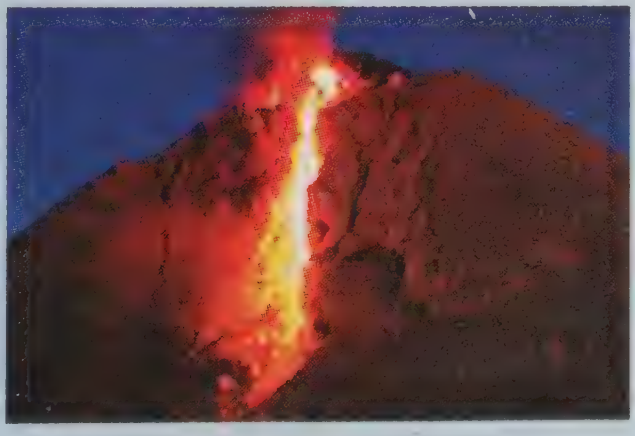
Volcanoes can also be formed when the tectonic plates move away from each other. The magma pushes up and lava forms. These types of volcanoes are found on the ocean floor.

The final place where you find volcanoes is over hotspots. These hotspot volcanoes can be anywhere, even out in the middle of a plate.

What is the difference between magma and lava?

The terms really refer to the same thing...molten rock. If someone is talking about magma, you know they are talking about when it is still underground. If they are talking about lava, you know they are talking about after it has erupted.

The temperature of the magma can be as high as 2760 degrees Celsius. Molten lava can reach temperatures of 1000 degrees Celsius, and rivers of molten lava can bury towns completely!



Molten lava from a volcano

What are storms?

When you hear the word 'storm' you naturally think of pouring rain accompanied by fierce winds, flashes of lightning and the rumble of thunder. Actually, a storm is any violent disturbance in our atmosphere, resulting in severe weather conditions. Storms begin as the sun heats an area of land or sea and causes warm air to rise very rapidly into higher, colder air in an unstable way.

There are many different types of storms. We are most familiar with the type of storm described above. Storms may be marked by hard wind resulting in a wind storm, and the thunder and lightning of a thunderstorm. There are also ice storms, dust storms and sandstorms. Storms move rapidly over land and sea and can cause great damage.

What are hurricanes?

You must have read about hurricanes in the newspapers, and also heard of hurricane warnings advising fishermen not to go out in the sea. When the winds of a tropical storm reach 110 kmph, then the storm is classified as a hurricane. Hurricanes are formed when large areas of the ocean become heated, and the air pressure over that area drops. Hurricanes start as a band of thunderstorms that begin spinning when they collide with trade winds.

Hurricanes move along at speeds between 25 and 50 kms per hour, as warm air continues to rise and swirl most powerfully near its centre. Hurricanes rotate in a counter-clockwise

Hurricane hits a ship

direction around an 'eye.' The eye of a hurricane is amazingly calm, with light winds and clear skies.

When a hurricane hits land, the blinding rain, strong winds and heavy waves can damage buildings, trees and cars. The heavy waves are called a storm surge. Storm surges are very dangerous and a major reason why you MUST stay away from the ocean during a hurricane warning or hurricane. Mercifully, hurricanes do not last long once they are inland.

Tornado and lightning

What is lightning?

Everyone has seen lightning, but do you know what lightning is? To put it simply, lightning is electricity. It forms in the strong up-and-down air currents inside tall dark clouds, as water droplets, hail, and ice crystals collide with one another. Scientists believe that these collisions build up charges of electricity in a cloud.

The positive and negative electrical charges in the cloud separate from one another, the negative charges dropping to the lower part of the cloud, and the positive charges staying ins the middle and upper parts. Positive electrical charge also builds upon the ground below.

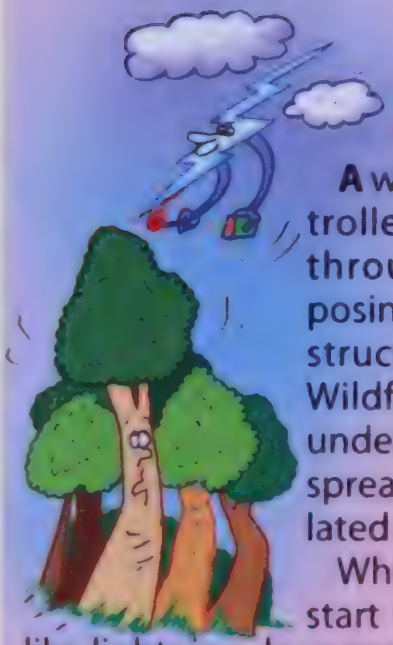
When the difference in the charges becomes large enough, electricity flows from the cloud down to the ground. It can also flow from one part of the cloud to another, or from one cloud to another cloud. When the positive and negative charges finally meet, there is a brilliant flash of light as lightning occurs.

What is thunder?

Lightning bolts are extremely hot, with temperatures of 16649 to 27760 degrees C. That's hotter than the surface of the sun!

When a bolt of lightning suddenly heats the air around it to such an extreme, the air instantly expands, sending out a vibration or shock wave that we hear as an explosion of sound. This is thunder.

If you are near the stroke of lightning you'll hear thunder as one sharp crack. When lightning is far away, thunder sounds more like a low rumble as the sound waves reflect and echo off hillsides, buildings and trees. Depending on wind direction and temperature, you may hear thunder for up to twenty or thirty kilometres.



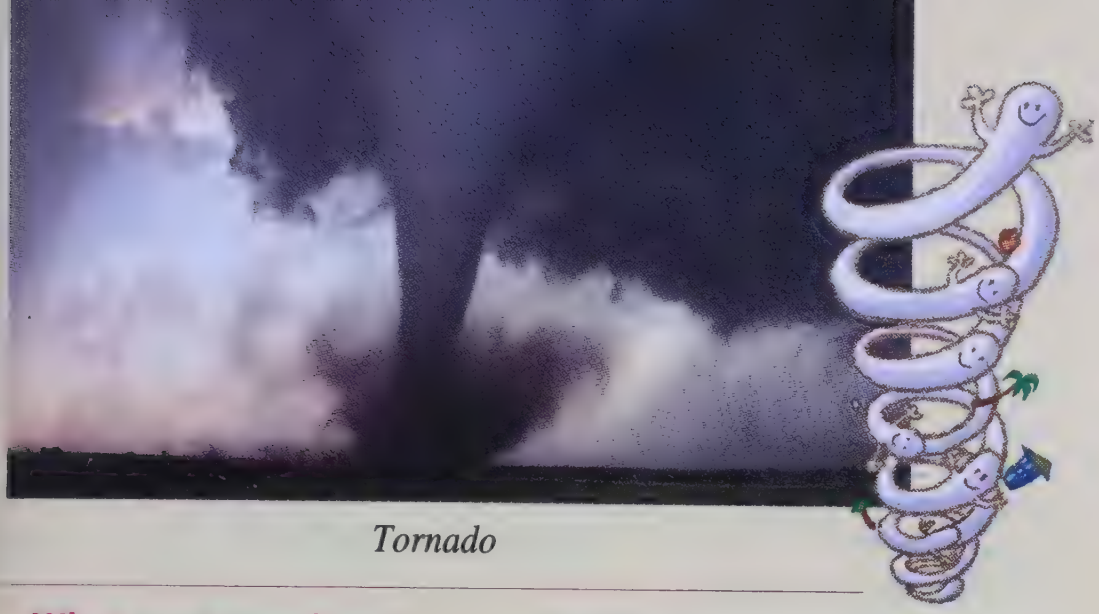
How do wildfires start?

A wildfire is an uncontrolled fire spreading through vegetation, posing danger and destruction to property. Wildfires can occur in undeveloped areas, and spread to thickly populated cities.

While some wildfires start by natural causes like lightning, humans cause four out of every five wildfires. Sometimes, this happens accidentally, sometimes wildfires are started deliberately. As a natural hazard, a wildfire is often the direct result of a lightning strike.

The predominant danger from wildfires is the destruction of timber, property and wildlife, and injury or loss of life to people living in the area.

Wildfire



Tornado

What are tornadoes?

A tornado is a violently rotating column of air which is in contact with both a cloud base and the surface of the earth. A tornado descends from a storm cloud without warning. Tornadoes come in many sizes, but are typically in the form of a funnel, with the narrow end touching the earth. Often, a cloud of debris encircles the lower portion of the funnel.

Most tornadoes occur in the United States, and there is a Tornado Alley which refers to the area of the United States in which tornadoes are most frequent. Although an official location of the term is not defined, the areas in between the Rocky Mountains and Appalachian Mountains are the areas usually associated with it.

Tornadoes are the most unpredictable and localized of the big winds, and can cause enormous damage. Fortunately, they rarely last for more than an hour.

What is El Nino?

El Nino means 'male child' in Spanish. It is a warm current appearing annually around Christmas time along the coast of Ecuador and Peru and lasting only a few weeks to a month or more.

Every three to seven years, an El Nino event may last for many months, causing significant changes in the weather. Scientists blame more storms, floods, droughts, tornadoes and loss of fish and marine plants to the prolonged appearance of El Nino every few years.

How fast do tornadoes travel?

The average forward speed of a tornado is 46kmph but it may vary from stationary to 100kmph or more. The most violent tornadoes can produce massive destruction with wind speeds of 400 kmph !

Did you know that some people track tornadoes for fun? They drive as close to the tornado as possible to take films and photographs...a very dangerous hobby indeed!

What are hailstones?

A hailstone is not a stone at all, but a small ball of ice. It starts its life in a thundercloud as a tiny ball of snow. The ball is tossed up and down in the cloud so often that it gets coated with layers of ice, like the layers of an onion. Eventually, these ice chips come down to earth as a hailstorm.

Hailstone

Hailstones are usually the size of peas, but the biggest hailstone seen so far is the size of a watermelon!

What is an avalanche?

An avalanche is a huge slab of snow and ice that suddenly breaks off the side or top of a mountain and races downhill. As layers of snow build up, cracks appear because of the snow's own weight, and the snow and ice suddenly start to slip and slide.

Avalanches can be deadly, as hundreds of tonnes of snow and ice shoot down the mountain slope at speeds of up to 320 kmph. Everything in its path is buried under snow, and specially trained dogs are used to sniff out and rescue people buried in an avalanche.

An avalanche

Why do floods occur?

Heavy continuous rain will make the water level in rivers rise very quickly, and flood the surrounding areas. Melting snow can combine with rain in the winter and early spring to cause floods.

Floods can also happen after sudden release of water from a dam. Floods are also caused when high tides, or tidal waves sweep onshore.

Flooded area

Floods can cause enormous damage, sweeping away homes, destroying crops and drowning people. But floods are also useful in that they deposit rich mud and silt on the surrounding fields, and this makes the land very fertile.

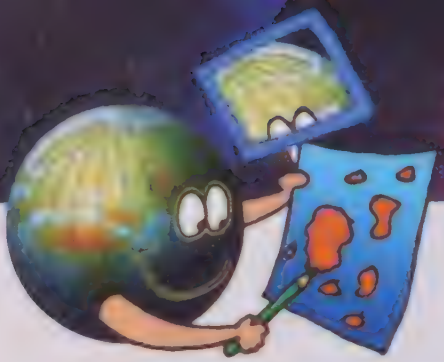
What is a tsunami?

A tsunami is a huge volume of moving seawater. It has nothing to do with tides, although it is sometimes mistakenly called a tidal wave.

These giant waves can travel for thousands of kms across the sea and still create energy that destroys buildings, trees, wildlife and people.

The word tsunami (pronounced soo-NAH-mee) is Japanese, and it means 'harbour wave', as these waves were first seen in harbours. Did you know that tsunamis have been known to lift up ships in a harbour and dump them in the middle of a town?

Tsunami



Maping

What is a map, and how is it made?

Maps are accurate representations of a part, or sometimes the whole, of the earth's surface. They are made on a flat paper, parchment, cloth or any material. Maps have been made since ancient times because they are a convenient way of summarizing information about an area or the world in which we live.

The earliest known maps were made in ancient Babylon. The early Egyptians and Greeks also knew the art of map making. Map making was revived in the Middle Ages, and received a great boost with the invention of printing and engraving.

Gerhard Mercator is the father of modern map making. It takes a skilled mathematician and artist to create a precise map .The first step is to fix the latitudes and longitudes of the area to be mapped. The land is

Gerhard Mercator

What is a topographic map?

A topographic map is a detailed and accurate graphic representation of cultural and natural features on the ground.

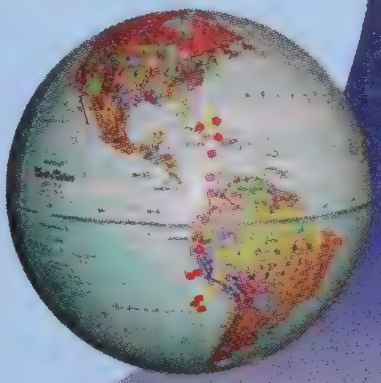
Topographic maps supply a general image of the earth's surface: roads, rivers, buildings, often the nature of the vegetation, the relief and the names of the various mapped objects.

Topographic maps use differ-

How is a globe made?

We know that the earth is a sphere, yet many of the maps of the earth are flat. A globe is the only perfectly accurate map of the earth, in which countries, oceans and other features are marked on a sphere. How are globes made?

Globes are spheres covered with paper on which the earth's features are printed. The paper consists of a series of triangles or strips, which are skillfully joined by experts. The flat pieces are stretched when wet so as to fit them correctly on the curved surface of the globe.



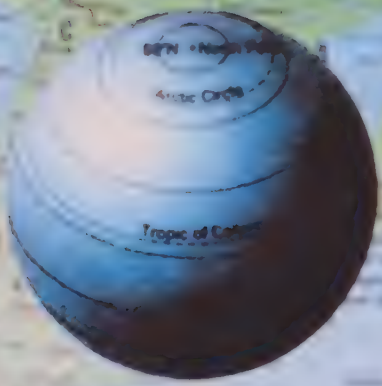
Because of their small size, globes can show only the major features. If the globe is too big, the paper will crumple and crease. So, for more detailed features, we still have to rely on maps.

surveyed using specialized instruments. Known fixed points are then plotted on paper in a chosen scale and measured heights. The map maker then fills in all the details of the land.

Today, sophisticated methods of surveying, aerial photography, satellite technology and computers make maps incredibly accurate and detailed, as well as much easier to make.

ent colours to denote different features. Settlements, roads, man made boundaries and other structures are shown in black or red. Vegetation is green, and water, including rivers and seas, are shown in blue. Hills and the counters of the land are marked in brown.

These maps are of immense value to everyone, from school children to army commanders!



Picture showing latitudes

Picture showing longitudes

What are latitudes and longitudes?

If you look at a map, you will see lines parallel to the equator drawn on it. These are the lines of latitude. You will also see vertical lines that intersect the lines of latitude at right angles. These are the lines of longitude.

Latitude lines are also known as parallels since they are parallel, and are an equal distance from each other. They are represented by the angle they make with the equator, and are called degrees.

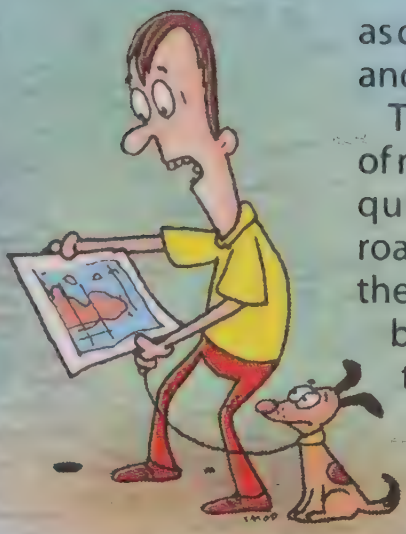
Each degree of latitude is approximately 111 km apart, and the latitude of a place is the number of degrees it lies north or south of the equator.

Longitude lines are also known as meridians. They meet at the

Which is the oldest map?

The oldest map known to man is a clay tablet. It was made 4300 years ago in Babylon, and was unearthed in 1930 at the excavated ruined city of Ga Sur. It is small enough to fit in the palm of your hand, and the surface of the tablet is inscribed with a map of a district bounded by two ranges of hills, and bisected by a water-course.

poles,and are widest at the equator. Zero degrees longitude is located at Greenwich, England (0°). The lines of longitude continue east and west till they meet and form the International Date-Line in the Pacific Ocean at 180 degrees.



The position of any place on earth is defined by the latitude and longitude it lies upon. Of course, we must remember that these are imaginary lines. They are not really drawn on the surface of the earth, but created to help us pinpoint the location of a place, and to draw maps accurately.

What are the uses of maps?

Maps are very useful in giving us an idea of a specific area, and of the world we live in. A map gives the location or position of places or features, and also gives us an idea of the relationship between certain features. For example: What district is the neighbour of another district? Which side of the road is the river on? Where is the nearest railway station? We can determine a lot of information from a map such as distances, directions and areas.

There are many types of maps, some of them quite specialized. A road map emphasizes the roads and towns but little else, while a topographic map, also called a general map, shows as much of the landscape, elevations, roads, towns etc as possible.

Why is a thematic map different from other maps?

A thematic map is a statistical or special purpose map. It displays the pattern of a a particular theme. In contrast to reference maps which show many geographic features, thematic maps focus only on certain topics such as as climate, population density or health issues.

A thematic map of weather

What are map scales?

The proportion chosen for a particular map is its scale. Selecting the appropriate scale depends on the size of the sheet of paper and the accurate placement of features. Ground area, rivers, lakes, roads, distances between features and other details must be shown proportionately smaller than they really are.

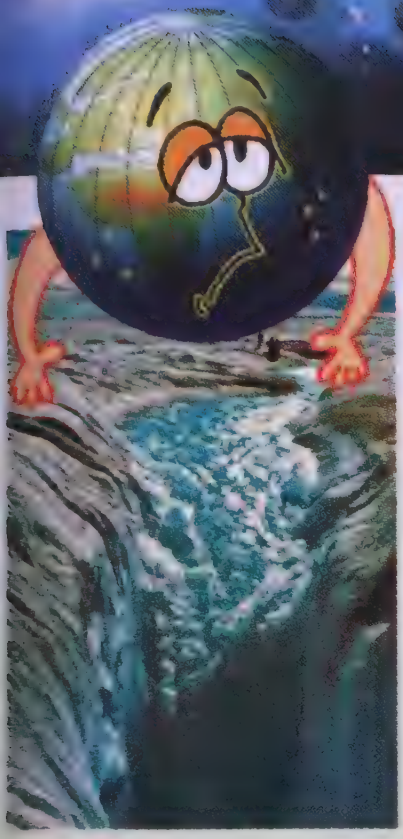
Simply defined, scale is the relationship between distance on the map and distance on the ground. A map scale usually is given as a fraction or a ratio —1/10,000 or 1:10,000. What does this actually mean?

This means that 1 unit of measurement on the map, whether it be 1 inch or 1 centimetre, represents 10,000 of the same units on the ground. If the scale were 1:63,360, for instance, then 1 inch on the map would represent 63,360 inches, or 1 mile, on the ground.

How is detailed mapping done?

The detailed mapping of an area can be done very easily now through aerial photography. Aerial photographs can not only give the height of certain features, but also appear as a three dimensional model. From a series of photographs taken from the air, a detailed map of a large area can be drawn in a fraction of the time taken by surveyors on the ground.

The Dying Earth



Melting glacier

How do climate changes affect the land?

Scientists tell us that the earth is becoming warmer every year. The reason for this is that the air is becoming more polluted with gases that trap the earth's heat. As a result, the earth is becoming hotter, and the water in the oceans is becoming warmer too.

The change to an increasingly warm climate has affected the land and the ocean in many ways. To begin with, the ice at the poles and in glaciers is melting, and flowing into the sea. This causes the sea level to rise, and widespread flooding of coastal areas during storms. At the same time, the climate is becoming drier in places away from the sea. Droughts are becoming much more common, and the land is becoming less able to support crops and cattle.

Why does carbon dioxide make the climate warm?

Studies of the Ice Ages have shown that levels of carbon dioxide in the air were much lower during that period. The amount of carbon dioxide in the air has gradually increased by 25 percent. This is mainly due to the burning of forests, the use of fertilizers and cars, as well as the burning of coal and oil in power stations.

It has also been noticed that the climate has become warmer as the levels of carbon dioxide have increased. So, it is more or less certain that carbon dioxide does play a role in the higher temperatures that are present worldwide.

Why is the greenhouse effect so called?

The greenhouse effect is the rise in temperature that the earth experiences because the water vapour, carbon dioxide, methane, ozone and nitrous oxide present in the atmosphere, trap energy from the sun. These gases are called greenhouse gases.

Greenhouse gases in the atmosphere behave much like the glass panes in a greenhouse. Sunlight enters the earth's atmosphere, passing through the blanket of greenhouse gases. As it reaches the earth's surface, land, water, and air absorb the sunlight's energy. Once absorbed, this energy is sent back into the atmosphere. Some of the energy passes back into space, but much of it remains trapped in the atmosphere by the greenhouse gases, warming our earth.

Without these gases, all the heat would escape back into

What is acid rain?

Acid rain is one of the most dangerous and widespread forms of pollution.

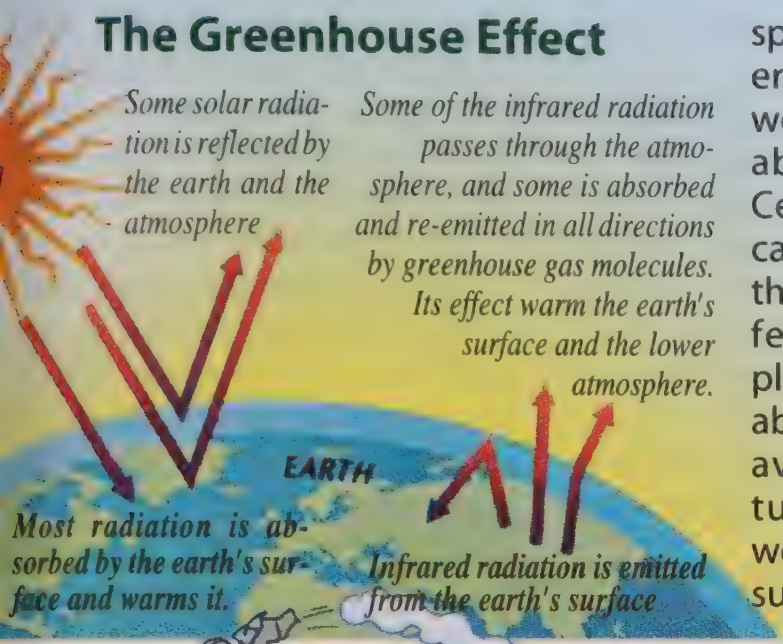
To put it simply, acid rain is rain that has a larger amount of acid in it than what is normal.

The acidity of rain in parts of Europe and North America has dramatically increased over the past few decades. It is now common in many places for rain to be ten to seventy times more acid than unpolluted rain.

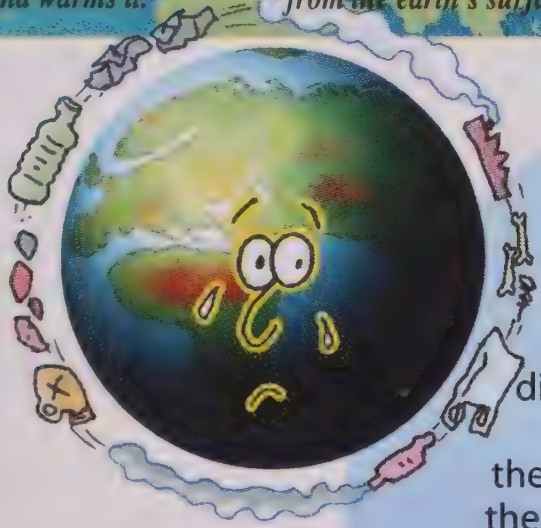
Trees, killed by acid rain

Acid rain is caused by smoke and gases that are given off by factories and cars that run on fossil fuels. When these fuels are burned to produce energy, the sulfur that is present in the fuel combines with oxygen and becomes sulfur dioxide. Some of the nitrogen in the air becomes nitrogen oxide. These pollutants go into the atmosphere, and

The Greenhouse Effect


Some solar radiation is reflected by the earth and the atmosphere
Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. Its effect warm the earth's surface and the lower atmosphere.
EARTH
Most radiation is absorbed by the earth's surface and warms it.
Infrared radiation is emitted from the earth's surface

space and earth's average temperature would be colder by about 16 degrees Celsius. In fact we can say that without the greenhouse effect, life on this planet would probably not exist as the average temperature of the earth would be too cold to sustain life.



What is pollution?

Pollution is when water, air or land becomes very dirty. Pollution can come in 4 different types affecting different types of areas in the world. Air pollution affects the air. Water pollution affects the water and marine life. Land pollution affects the land, destroying life and the environment, and there is also noise pollution that can affect our hearing. Pollution is gradually destroying our planet, and unless we take drastic measures to control it, it will destroy life on the planet.

become acid. Sulfur dioxide and nitrogen oxide are also produced when coal is burnt for fuel.

Acid rain destroys trees, kills fish in lakes, harms wildlife and eats away the stonework in buildings. It also gives us asthma, headaches, throat aches and coughs!

How does pollution affect the oceans?

Pollution of the world's oceans is quickly becoming a major problem on earth. The world's oceans are a virtual dumping ground for trash. Sometimes the garbage includes junked out fishing nets, plastics, and even general household garbage.

Garbage in the oceans is a serious issue as fish entangle themselves in fishing nets and animals sometimes eat trash products and die. There are numerous examples each year of dolphins, sharks and whales entangling themselves in fishing nets and dying from oxygen starvation.

Polluted shore

Sewage is yet another major form of ocean pollution. When sewage is disposed of in the ocean, there will often be algae blooms in the water. Algae blooms lead to the loss of dissolved oxygen. When the oxygen level in the water falls, many organisms in the ocean die from being unable to breathe properly

Toxic pollutants in the ocean have massive impact on plants and animals. Industries release heavy metals into the water which collect in the tissues of predators such as whales and sharks. Sometimes, this type of poisoning can cause birth defects and nervous system damage.

When polluting material enters the food chain, it becomes more and more dangerous, as bigger fish eat smaller fish. We must remember that we eat these fish too, and can suffer the greatest damage of all.

How can we prevent air pollution?

Many products that are used at home, in the yard, or at the office are made with smog-forming chemicals that escape into the air. As far as possible,

ask your parents to use 'air-friendly' products. Products such as cleaning agents, paints, and glues often contain harmful chemicals. Use them sparingly and carefully.

Saving energy helps reduce air pollution. Whenever you burn fossil fuel, you pollute the air. Use less petrol, natural gas, and electricity. Be especially careful to turn off lights and fans so as not to waste electricity. You can also use recycled paper and other recycled products.

Air pollution

It is only through the determined efforts of scientists, business leaders, legislators, and individuals that we can reduce the amount of air pollution on our planet. But, to make a beginning, you too must think of more and more ways that you can, in your own way, prevent air pollution.

What are the effects of air pollution?

Air pollution can cause health problems including burning eyes and nose, itchy irritated throat, and breathing problems. Some chemicals found in polluted air can cause cancer, birth defects, brain and nerve damage, and long-term injury to the lungs and breathing passages in certain circumstances.

Air pollution can also damage the environment and property. Trees, lakes, and animals have been harmed by air pollution. Air pollution can damage buildings, monuments, statues, and other structures. Sometimes, air pollution results in a haze in the atmosphere, which reduces visibility so that drivers and pilots cannot see properly.

What is global warming?

Global warming refers to an average increase in the Earth's temperature, which in turn causes changes in climate. A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and have long reaching impact on plants, wildlife, and humans.

Scientists agree that the burning of fossil fuels like oil and coal cause gases known as greenhouse gases to escape into the air, and that these gases are causing most of the warming. They trap the sunlight that bounces of the surface of the earth, and reflect it back to earth. This increases the temperature on earth.

Another cause is deforestation or the cutting down of trees. Trees soak up carbon dioxide, one of the greenhouse gases, from the air, and by cutting them, we increase the level of carbon dioxide in the air.

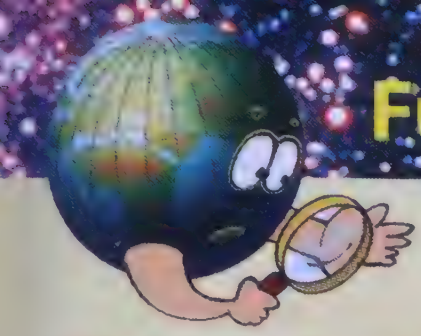
What is soil pollution?

Soil pollution is the build-up in the soil of poisonous compounds, chemicals, salts, radioactive materials, or disease causing agents, which harm plant growth and animal health.

Soil pollution is mainly due to chemicals in herbicides or weed killers and pesticides which are poisons that kill insects and other pests. Litter or waste material dumped in public places such as streets, and picnic areas, at bus stops and near shops also causes soil pollution.

The most common soil pollutants include metals and their compounds, organic chemicals oils and tars, radioactive materials and toxic gases.

Future Of The Earth



What is the future of the earth?

If we try to look into future, scientists agree that the global warming, caused by the release of certain gases into the air by cars, factories and power stations, will make the earth much warmer year by year.

As a result, glaciers will melt, and the sea level will rise everywhere. Many coastal areas will be submerged. There will be changes in climate with more violent storms, shifting rainfall patterns and more areas of drought.

The earth will continue to change as rivers and glaciers erode hilly areas, while new mountains will be formed. The continents will continue drifting, and the Atlantic will widen, Africa will collide with Europe closing the Mediterranean, and Australia will collide with S.E. Asia!

Earth's landscape will be transformed dramatically, with a quarter of plants and animals facing extinction. Humans will face widespread water shortages while famine and disease will increase.

Yes, the future does look gloomy, and we must act now to prevent global warming and save our planet!

STAR FACT

The moon is the earth's only natural satellite, and it is the closest celestial object to earth. It has a diameter of one quarter that of the earth (3,476 km). It is almost big enough for the earth and moon to be thought of as a double-planet system. The average distance between moon and earth is 3,84,400km. Its surface gravity is about one-sixth that of earth.

Why do we have to take extra care of the land upon our earth?

Land is limited. We must repect it and use it carefully, or it will no longer be enough to meet the needs of the increasing population.

We must take measures to prevent soil erosion, or else the land we have will not be able to support crops. Farmers must use chemical fertilizers carefully, so that they do not pollute the soil and water. New breeds of crops can survive in tough conditions, but no one knows their effect on the environment. Traditional methods of farming do the least harm to the land.

Desalination plant in Saudi Arabia

Mining for metals should also be controlled, so that we do not harm the environment. Even industries like tourism must be controlled so that the environment is protected.

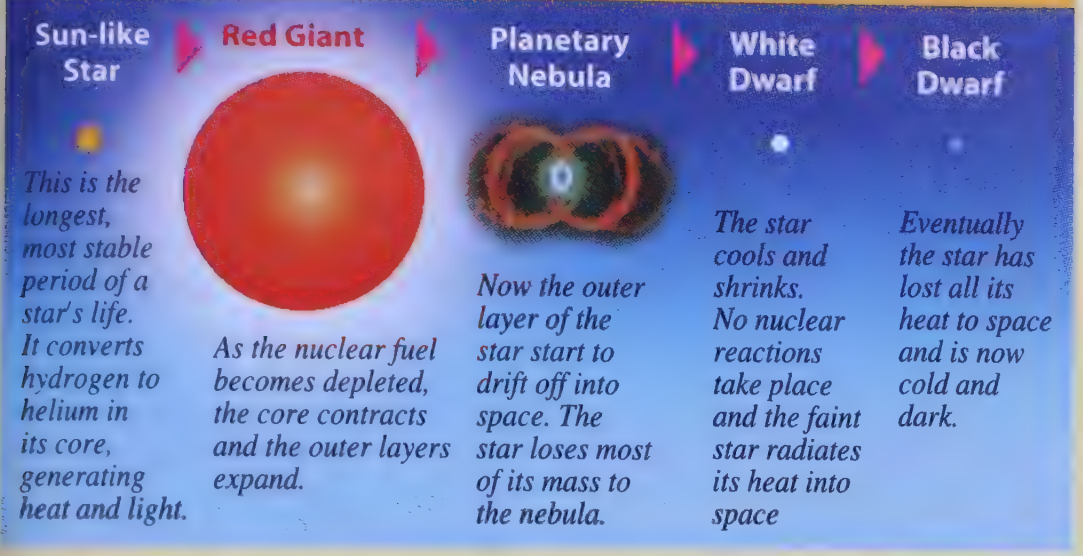
What will the supply of water be like in the future?

We are all very careless when using water, thinking that the supply is endless. However, the fact is that the world's water resources are already becoming scarce. Today, water is regarded as a precious commodity with countries and states quarrelling over fresh water sources.

Unless we act now, we may find ourselves fighting for even a drop of fresh water to drink. Pollution of our rivers and streams must be stopped at once, and we must not waste water.

Many other ideas are being tested for improving fresh water supplies, including shipping fresh water in supertankers, towing ice bergs from the poles to water-scarce areas, and making artifical rain. Desalination, or the removal of salt from sea water is one way to increase our supplies of fresh water.

Death of a Sunlike star


Sun-like Star
Red Giant
Planetary Nebula
White Dwarf
Black Dwarf
This is the longest, most stable period of a star's life. It converts hydrogen to helium in its core, generating heat and light.
As the nuclear fuel becomes depleted, the core contracts and the outer layers expand.
Now the outer layer of the star start to drift off into space. The star loses most of its mass to the nebula.
The star cools and shrinks. No nuclear reactions take place and the faint star radiates its heat into space
Eventually the star has lost all its heat to space and is now cold and dark.

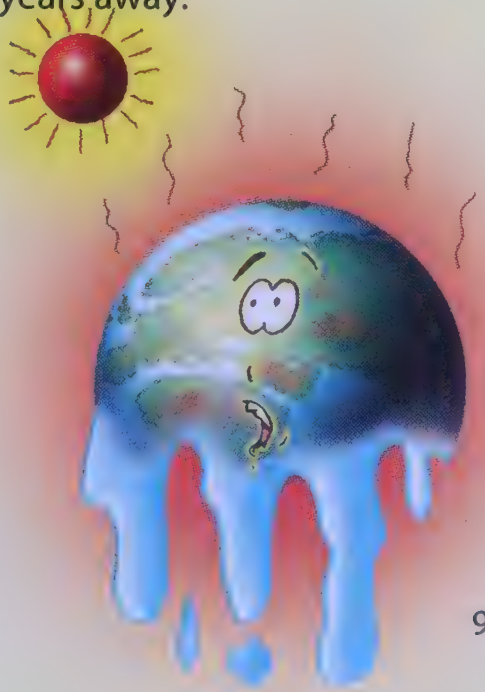
How long will the earth exist?

No one really knows. But, two noted University of Washington astrobiologists say the planet already has begun the long process of becoming a burned-out cinder, eventually to be swallowed by the sun.

The sun itself will change into a red giant, in after 4 billion years. The core of the sun will become hotter than what it was, and this heat will cause the outer parts of the sun to swell. The sun will become a giant, but its radiation will become weak. Weak radiation is red, so the sun becomes a red.

When all this happens, most animals and plants will become extinct. The oceans will vaporize. Finally, the ever-expanding sun, transformed into a red giant, will engulf the planet. Any evidence that the earth ever existed will just melt away.

The disappearance of our planet is still more than 5 billion years away.



What does the end of planet earth refer to?

The end of planet earth refers to theories about when the earth will completely cease to exist, or when it can no longer support life.

One theory is that the sun will become so hot and huge that it will swallow the earth. Another theory is that the sun will become so hot that all the water vapour in the air, and all the oceans, seas, rivers and sources of water will evaporate. The earth will thus become unable to support life.

Some scientists believe that there will be a huge collision with another galaxy, and our solar system itself will be wiped out.

What are the challenges the earth has to face from outside in the future?

The first threat will come from the moon. The moon's gravitational pull affects the earth's land, sea and air too, and is gradually slowing down the earth's speed of rotation. This means that days will become as long as 36 hours!

In the meantime, the sun will first grow bigger and redder, and cause the oceans to boil. Then it will gradually shrink and cool and glow only feebly for a long long time. While this is happening, the moon will drift so far off that it is no longer visible, and the days will be lit only by the wan and watery light of the fast fading sun, while the nights will be pitch black.

Of course, the earth will also be facing the ever present challenge of being hit by a giant asteroid or other body from space, and the collision can devastate our planet as we know it.

The moon

Launching of a space shuttle

What will happen to the human race in the future?

Even the most brilliant scientist cannot answer this question. Will man find another planet which can support life, and move there while the earth is being destroyed? We don't know.

As the sun grows larger and hotter, perhaps some form of highly evolved man will go into a specially prepared cave underground, taking as much air and water and as possible to build thermonuclear reactors that will be able to power the earth and make it habitable again. Can this happen? We really don't know.

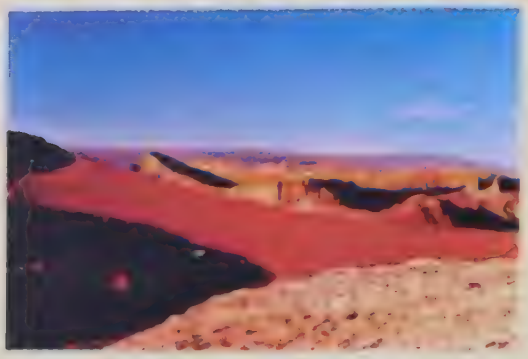
Will the human race be around when the earth is destroyed? Or will it die out before the planet meets its end? The only honest answer to this question is...we don't know!

Can man find a better place to live in the future?

We already are exploring space. Instruments, animals and human beings are today circling the earth in space stations. Man has landed on the moon, and our space scientists have fired robot spacecrafts at Mars and Venus. Soon maybe, interplanetary trips will be common.

We may even start making trips outside the solar system in the next 100 years. It is not impossible that on one of these trips, we may discover a planet that is capable of supporting life as we know it. If that happens, mankind can escape from earth before it is completely destroyed, and make a new planet its home.

Earth Records



Atacama desert

Which is the driest place on earth?

We all know that deserts are dry because they receive little or no rain, but do you know that the driest place on earth has not received rain for 400 years? It is a part of the Atacama desert in Chile, in South America.

Which is the coldest place on earth?

If you think our winters are cold, you should go to Antarctica. It is the coldest place on earth, and the lowest ever temperature on earth was recorded there in 1938...a chilly minus 82 degrees Celsius! Animals and birds that live here have thick fur and a thick layer of fat under their skin to keep them warm.

Which is the deepest ocean?

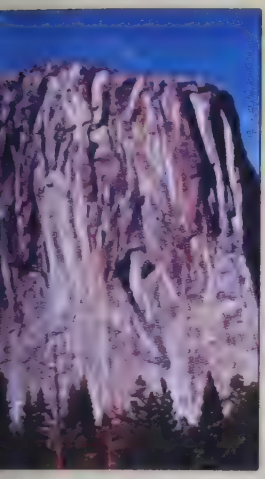
The Pacific ocean is the deepest ocean. The Indian ocean comes next, and the Atlantic ocean comes third. Pacific ocean has the average depth of 4281 metres.

Which is the sandiest desert?

Although we think of deserts being covered by sand, the fact is there are different types of deserts...some are even covered with snow and ice! Even in deserts that are hot and dry, there are some deserts covered by rocks and shrubs. The sandiest desert though is the Arabian desert, one third of which-2.6 million square kilometres- is covered with sand.

Where is the tallest granite monolith?

A monolith is a large column made of a single block of stone. In the Yosemite National Park, California, there is a granite monolith that is the tallest granite monolith in the world. It is over 1095 metres tall.



Tallest monolith

Which is the world's largest forest?

Most people think that the largest forests are to be found in the tropics, where the vegetation is lush and green, and things grow fast. But the world's largest forest is not in the tropics, but in Northern Russia. It is a vast forest of conifers that covers 4 million kilometres. In comparison the largest forest in the tropics is the Amazon rainforest in the basin of the Amazon River, but it covers a little more than half the area of the coniferous forest…just 2.5 million kilometres.

Which is the largest lava lake?

We know that lava is the fiery molten rock that is thrown out of a volcano during an eruption. Most of the lava will cool down to form rock. Some of it collects as a lake. The largest lava lake in the world is in the Congo. It lies in the crater of a shield volcano called Mount Nyiragongo, and is over 250 metres wide. The fluid lava bubbles and boils with red hot fury. It is a sight that is truly awesome.

Which is the tallest mountain face?

The tallest mountain face lies in Pakistan. It is the Rupal face of the Nanga Parbat in the Western Himalayas. It rises as a single face 5000 metres from the valley floor to its summit. The mountain itself is the highest in Pakistan, and the eighth highest in the world.

Which is the largest cave on earth?

The largest cave on earth is in Malaysia. It is the Sarawak Chamber in Sarawak, and was discovered in 1980. It is 70 metres high, 700 metres long, and 300 metres wide. This means it is as tall as a 23 storey building, and as big as three soccer fields put together!

Which was the world's longest earthquake?

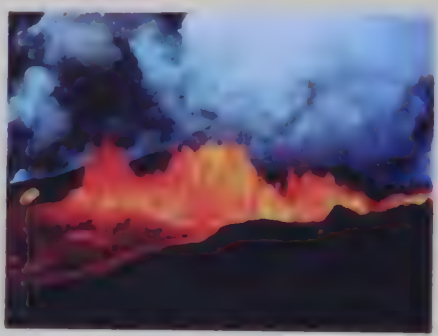
An earthquake usually lasts for a few seconds or a few minutes. The world's longest earthquake occurred on December 26th 2004, and lasted for almost 10 minutes at some places. It happened in the Indian Ocean, in the Sumatra–Andaman Islands. Its after effects included a devastating tsunami which wreaked death and destruction in the coastal areas of South India as well.

Which is the fastest growing mountain on earth?

If you look at a mountain, you cannot see it grow, or being worn away. But the fact is that mountains are being worn away all the time... and some mountains are growing too. The fastest growing of these mountains is Nanga Parbat in Pakistan. It was formed 30 to 50 million years ago when two continental plates collided, and is still growing at the rate of 7mm per year!

Which is the largest active volcano?

The largest active volcano is in Hawaii. It is the Mauna Loa, a broad gentle dome that is 120 kilometres long and 50 kms wide. Its lava flow occupies more than 5125 square kilometres of the island, which is roughly half its area.



Lava from Kilauea volcano

The world's most active volcano is also in Hawaii. It is Kilauea which has erupted continuously since 1983. It is also the youngest of the volcanoes in Hawaii.

Which is the youngest volcano?

Kilauea may be the youngest volcano in Hawaii, but the youngest volcano in the world is Paricutin in Mexico. It erupted in a corn field on 20th February, 1943 and continued erupting till 1953. It is only about 336 metres

tall, and though small, is considered to be one of the seven wonders of the natural world.

Which is the wettest desert on earth?

It is true that deserts receive very little rain...or no rain at all. But did you know that there is a desert that has two wet seasons, and receives between 120mm and 300mm of rain every year? This is the Sonora desert in Arizona, USA. Of course, this does not mean that this desert is not hot...in summer temperatures soar to above 40 degrees C in the daytime!

Sonora desert

Which is the largest sand island?

A sand island is an island that is, in effect, a sanddune surrounded by the sea. The largest sand island lies off the coast of Queensland in Australia. It is Frazier Island, and it is over 120 kms long and 30 kms wide. Although it is a sand dune, it has rain forests too, making it the only place in the world where rain forests grow on a sand dune!

Frazier Island

CLARIFICATIONS & CORRECTIONS

It is our policy to correct errors, and present differing views and clarifications about the contents in previous issues. Please send in your feedback, mentioning the title and page number.

THE FIRST CAR TO CRASH!

Prof. Krishnakant from Mumbai has an interesting titbit to add to the *Tell Me Why* issue on *Transportation.* According to him the first ever motor accident happend on the very first run of the first motor car, built by Nicholas Cugnot, in 1769. It ran on steam. The car had a defective steering system and ran into a wall.

There is another version that it was not Cugnot's first car, but the second car that met with the first accident. Cugnot's first car was used by the French Army to move cannons. It had three wheels and had a speed of upto 6kms/hour. That was too slow to be of practical use. Cugnot made another 'advanced' car in 1771. The machine reportedly ran quite well. On one occasion it ran into a wall, which also claims to be the world's first motor accident. The vehicle is still displayed in the Conservatoire National des Arts et Metiers in Paris!

Editor

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I Wonder Why? The question of the month

Aren't there many little things you have wondered about, but didn't know whom to ask? Send us your questions, and we will give you the fascinating reasons behind the incredible mysteries of life

'How does the barcode system work?'

Barcodes are an indispensable part of modern consumer products. They appear as widths and spacings of printed parallel lines, or patterns of dots, concentric circles, and text codes hidden within images.

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Barcodes serve as identification tags. They help keep track of an item, and quickly retrieve information about it. Barcodes can be read by optical scanners called barcode readers or scanned from an image by special software. When the laser beam is reflected from a bar code, the reader detects a pattern of reflection from the dark and light areas. This produces a corresponding electrical signal. This signal is translated to digital code by the reader's microprocessor. The microprocessor looks up the digital code in a database to identify the product and the data associated with it.

The first barcode was developed in 1948 by two American graduate students, Bernard Silver and Norman Joseph Woodland. They got a U.S. patent for their invention in 1952. However, barcodes were put to commercial use only in 1966, and they were not commercially successful until the 1980s.

MANORAMA TELL ME WHY - The Earth

Chief Editor : Ammu Mathew, Editor-in-Charge : N. M. Mohanan*

Printed and Published by V. Sajeev George, on behalf of M.M. Publications Ltd, P.B. No. 226, Kottayam-686 001 at M.M. Publications Ltd, P. B. No. 226, Kottayam-686 001 and Malayala Manorama Press, Kottayam -686 039 and published from M.M. Publications Ltd, P. B. No. 226, Kottayam-686 001

Editor: Ammu Mathew

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Which African country has three capitals?

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